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SELECTED WATER RESOURCES ABSTRACTS

VOLUME 4, NUMBER 6
MARCH 15, 1971

W71-02751 -- W71-03300

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SELECTED
WATER RESOURCES ABSTRACTS

A Semimonthly Publication of the Water Resources Scientific Information Center,
Office of Water Resources Research, U.S. Department of the Interior

VOLUME 4, NUMBER 6
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Use of funds for printing this publication approved by the Director of the Bureau of the Budget, September 4, 1968.

As the Nation's principal conservation agency, the Department of the Interior has basic responsibilities for water, fish, wildlife, mineral, land, park, and recreational resources. Indian and Territorial affairs are other major concerns of America's "Department of Natural Resources."

The Department works to assure the wisest choice in managing all our resources so each will make its full contribution to a better United States—now and in the future.

FOREWORD

Selected Water Resources Abstracts, a semimonthly journal, includes abstracts of current and earlier pertinent monographs, journal articles, reports, and other publication formats. The contents of these documents cover the water-related aspects of the life, physical, and social sciences as well as related engineering and legal aspects of the characteristics, conservation, control, use, or management of water. Each abstract includes a full bibliographical citation and a set of descriptors or identifiers which are listed in the **Water Resources Thesaurus** (November 1966 edition). Each abstract entry is classified into ten fields and sixty groups similar to the water resources research categories established by the Committee on Water Resources Research of the Federal Council for Science and Technology.

WRSIC IS NOT PRESENTLY IN A POSITION TO PROVIDE COPIES OF DOCUMENTS ABSTRACTED IN THIS JOURNAL. Sufficient bibliographic information is given to enable readers to order the desired documents from local libraries or other sources.

Selected Water Resources Abstracts is designed to serve the scientific and technical information needs of scientists, engineers, and managers as one of several planned services of the Water Resources Scientific Information Center (WRSIC). The Center was established by the Secretary of the Interior and has been designated by the Federal Council for Science and Technology to serve the water resources community by improving the communication of water-related research results. The Center is pursuing this objective by coordinating and supplementing the existing scientific and technical information activities associated with active research and investigation program in water resources.

To provide WRSIC with input, selected organizations with active water resources research programs are supported as "centers of competence" responsible for selecting, abstracting, and indexing from the current and earlier pertinent literature in specified subject areas.

Additional "centers of competence" have been established in cooperation with the Environmental Protection Agency. A directory of the Centers appears on inside back cover.

The input from these Centers, and from the 51 Water Resources Research Institutes administered under the Water Resources Research Act of 1964, as well as input from the grantees and contractors of the Office of Water Resources Research and other Federal water resources agencies with which the Center has agreements becomes the information base from which this journal is, and other information services will be, derived; these services include bibliographies, specialized indexes, literature searches, and state-of-the-art reviews.

Comments and suggestions concerning the contents and arrangements of this bulletin are welcome.

Water Resources Scientific Information Center
Office of Water Resources Research
U.S. Department of the Interior
Washington, D. C. 20240

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02 WATER CYCLE
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03 WATER SUPPLY AUGMENTATION AND CONSERVATION
Includes the following Groups: Saline Water Conversion; Water Yield Improvement; Use of Water of Impaired Quality; Conservation in Domestic and Municipal Use; Conservation in Industry; Conservation in Agriculture.

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ABSTRACT SOURCES

SELECTED WATER RESOURCES ABSTRACTS

01. NATURE OF WATER

1B. Aqueous Solutions and Suspensions

PREPARING POLYWATER AND OTHER ANOMALOUS LIQUIDS,
Worcester Polytechnic Inst., Mass. Dept. of Chemistry.
For primary bibliographic entry see Field 02K.
W71-03112

EVIDENCE THAT POLYWATER IS A COLLOIDAL SILICATE SOL,
Naval Research Lab., Washington, D.C.
Willard D. Bascom, Edward J. Brooks, and Bradford N. Worthington., III.
Nature, Vol 228, No 5278, p 1290-1293, December 26, 1970. 4 p, 7 fig, 10 ref.

Descriptors: *Water properties, *Water, *Water structure, *Silicates, *Colloids, Synthesis, Laboratory tests, Condensation, Electrical conductance, Synthesis, Spectroscopy, Water vapor, Physical properties, Viscosity, Gels.
Identifiers: *Polywater, *Anomalous water, *Sols, Capillaries.

Analysis of residues from condensation of 'polywater' using the electron probe showed significant amounts of silicon and sodium, suggesting that the unusual properties of 'polywater' may be due to the presence of silica or silicate. Experiments were conducted in an apparatus designed to allow the capillaries to be evacuated independently of the water to reduce the chance of spray reaching the capillaries during the pump-down. Electron probe analysis of the residues from 'Pyrex' revealed sodium and silicon in easily detectable amounts. Sodium was most strongly evident in the particulate matter within the residue and the silicon level was highest near the edge. The residues from condensate in silica were thinner and therefore more difficult to analyze than the residues from 'Pyrex.' Nonetheless, the electron probe revealed significant levels of sodium and silicon in the thicker regions near the edges. (Woodard-USGS)
W71-03113

02. WATER CYCLE

2A. General

SOIL SURFACE CHARACTERISTICS AND RAINFALL-RUNOFF-MOISTURE RELATIONSHIPS ON COASTAL PLAIN SOILS,
Auburn Univ., Ala. Water Resources Research Inst.
For primary bibliographic entry see Field 02G.
W71-02751

GEOCHEMICAL BALANCE OF A SMALL WATERSHED AND ITS GEOMORPHIC IMPLICATIONS,
Maryland Geological Survey, Baltimore; Vanderbilt Univ., Nashville, Tenn. Dept. of Geology; and Johns Hopkins Univ., Baltimore, Md. Dept. of Earth and Planetary Sciences.
For primary bibliographic entry see Field 02K.
W71-02761

A METHOD FOR RUNOFF-MAPPING FROM PRECIPITATION AND AIR TEMPERATURE DATA,
H. Liebscher.
In: Symposium on World Water Balance, Vol 1, International Association of Scientific Hydrology Publication No 92, p 115-121, July 1970. 7 p, 3 fig, 8 ref.

Descriptors: *Mapping, *Water balance, *Synoptic analysis, Rainfall-runoff relationships, Evapotranspiration, Data collections, Gaging stations, Data processing, Maps, Hydrologic cycle, Hydrologic data, Runoff, Streamflow.
Identifiers: Federal Republic of Germany.

A simple method is given for obtaining runoff maps from precipitation and air temperature data. It has proven of considerable practical value in the Federal Republic of Germany. The procedure can also be used for determining the long-term depth of runoff in areas for which runoff data are not available. Of all related factors, precipitation is the one that exerts the strongest influence on mean runoff depth and specific yield. If approximate evapotranspiration values for all stations concerned have been determined from precipitation and air temperature data, it is possible to get from the difference between precipitation and evapotranspiration approximate information on long-term mean runoff depth or specific yield. With the aid of the maps thus obtained, it is easy to determine the values required for water balance by planimetering the areas between the isolines. (Knapp-USGS)
W71-02767

SURFACE WATERS AS ELEMENTS OF THE WORLD WATER BALANCE,
Moscow State Univ. (USSR).
G. P. Kalinin, and K. Szesztay.
In: Symposium on World Water Balance, Vol 1, International Association of Scientific Hydrology Publication No 92, p 102-115, July 1970. 14 p, 12 fig, 11 ref.

Descriptors: *Surface waters, *Water balance, *Hydrologic cycle, *Synoptic analysis, Hydrologic budget, Climate, Weather, Weather patterns, Rainfall-runoff relationships, Precipitation (Atmospheric), Runoff, Streamflow.
Identifiers: World water balance.

There is a sharp asymmetry in the quantitative distribution and dynamic significance of the elements of the global water system. Basic features of the surface water systems and those of the streamflow regime are specified by climatic conditions. There are well defined regional time patterns in the distribution of the annual river flow within the northern hemisphere which may be emphasized by the typical pressure topography of the troposphere during periods of western atmospheric circulation. In spite of time correlations the laws of ergodicity can be applied to annual streamflow data if they are properly adjusted and data of sufficiently large regions are synthetized. Under given climatical conditions, the amount and time variation of baseflow are controlled by geohydrological characteristics. Changes in surface area of lakes and reservoirs may considerably affect the water balance and quality regimes. (Knapp-USGS)
W71-02768

CYCLIC VARIATIONS OF RIVER DISCHARGE IN THE NORTHERN HEMISPHERE,
State Hydrological Inst., Leningrad (USSR).
For primary bibliographic entry see Field 02E.
W71-02778

WORLD WATER BALANCE (GENERAL REPORT),
Akademiya Nauk SSSR, Moscow. Institut Geografii.
M. I. Lvovitch.
In: Symposium on World Water Balance, Vol 2, International Association of Scientific Hydrology Publication No 93, p 401-415, July 1970. 15 p, 1 fig, 6 tab, 83 ref.

Descriptors: *Water balance, *Latitudinal studies, *Earth (Planet), *Synoptic analysis, *Reviews, Hydrologic cycle, Climatic data, Meteorological data, Hydrologic data, Equations, Surface waters, Groundwater, Land, Oceans, Precipitation (Atmospheric), International Hydrological Decade.

The concept of world water balance is reviewed in general and its importance, in particular for the advancement of knowledge of hydrological processes occurring on the earth and for estimating world water resources is emphasized. A historical review of various estimates made by different scientists for different parts of the hydrological cycle is given with relevant tables. The author has made a critical study of various methods used for such estimates and has separated those elements which need further research. (Woodard-USGS)
W71-02781

SIMULATION OF THE HYDROLOGIC CYCLE OF THE GLOBAL ATMOSPHERIC CIRCULATION BY A MATHEMATICAL MODEL,
Environmental Science Services Administration, N. J., Geophysical Fluid Dynamics Lab.
Syukuro Manabe, and J. Leith Holloway, Jr.
In: Symposium on World Water Balance, Vol 2, International Association of Scientific Hydrology Publication No 93, p 387-400, July 1970. 14 p, 11 fig, 20 ref.

Descriptors: *Hydrologic cycle, *Latitudinal studies, *Mathematical models, *Synoptic analysis, *Atmosphere, *Climates, *Earth (Planet), Circulation, Equations, Hydrology, Meteorology, Climatology, Land, Oceans, International Hydrological Decade.

A mathematical model of the global atmospheric circulation is constructed. The model is capable of simulating some of the fundamental features of the climate and hydrologic cycles in the earth's atmosphere. The potential usefulness of such a model for the study of hydrology and climatology on a global scale is discussed. (Woodard-USGS)
W71-02782

A STUDY OF THE ATMOSPHERIC HEAT AND MOISTURE BUDGET BETWEEN EQUATOR AND 60 DEG N DURING THE WINTER AND SUMMER SEASONS,
Wisconsin Univ., Madison.
For primary bibliographic entry see Field 02B.
W71-02783

SOME MEASUREMENTS OF THE MERIDIONAL FLUX OF WATER VAPOR ACROSS 30 DEG N,
British Meteorological Office, Brackwell (England).
For primary bibliographic entry see Field 02B.
W71-02784

STUDY OF WATER BALANCE ELEMENTS OF FOREST AND FIELD WATERSHEDS,
State Hydrological Inst., Leningrad (USSR).
O. I. Krestovsky, and S. F. Fedorov.
In: Symposium on World Water Balance, Vol 2, International Association of Scientific Hydrology Publication No 93, p 445-451, July 1970. 7 p, 1 fig, 16 ref.

Descriptors: *Water balance, *Watersheds (Basins), *Forests, *Cultivated lands, Hydrologic cycle, Hydrologic budget, Synoptic analysis, Meteorology, Climatology, Vegetation, Precipitation (Atmospheric), Runoff, Surface waters, Groundwater, Soil moisture, Evaporation, Water storage, Evapotranspiration, International Hydrologic Decade.
Identifiers: USSR.

Relations between main elements of water balance of forest and field watersheds in the European part of the USSR are given according to scientific results obtained by the Valdai research hydrological laboratory. Water losses by evaporation are approximately equal in the forest and in the field, but forest stimulates the increase of precipitation and total runoff. (Woodard-USGS)
W71-02786

WATER BALANCE AND EARTH UNBALANCE,
Geological Survey, Lubbock, Tex.
T. E. A. van Hylckama.
In: Symposium on World Water Balance, Vol 2, International Association of Scientific Hydrology Publication No 93, p 434-444, July 1970. 11 p, 5 fig, 2 tab, 35 ref.

Descriptors: *Water balance, *Earth (Planet), Hydrologic budget, Hydrologic cycle, Synoptic analysis, Meteorology, Climatology, Water storage, Soil moisture, Precipitation (Atmospheric), Land, Oceans, Atmospheric pressure, Equations, International Hydrological Decade.
Identifiers: *Earth's rotation effects.

Computations of the water balance of the world show that in March 6.6 x 10 to the 15th power kg more water is stored on land than there is in September. Most of this water occurs in the form of snow and soil moisture on the North American and North Eurasian continents. Observations made from tidal gage records show that there is 6 x 10 to the 15th power kg more water in the ocean in October than there is in March. The difference may be found in the air where, in September there is some 0.6 x 10 to the 15th power kg more water than in March. Winds, changes in atmospheric pressures, ocean currents, and annual shifts of moisture between land and sea cause a wobble in the axis of rotation. Hence, there is a variation in latitude as determined by astronomical observations, and the poles describe small ellipses with the mean diameter of about 6 meters. The components of the mean storage are presented together with the values of the excitation function in the two hemispheres due to the movement of the water over the earth's surface. (Woodard-USGS)
W71-02787

COMPARATIVE HEAT BALANCE CALCULATIONS - FIRST RESULTS OF A GLOBAL INVESTIGATION,
Bonn Univ., (Western Germany).
For primary bibliographic entry see Field 02B.
W71-02788

MERIDIONAL PROFILES OF THE NORTHERN HEMISPHERE WATER BALANCE,
Nevada Univ., Reno. Desert Research Inst.
C. K. Stidd.
In: Symposium on World Water Balance, Vol 2, International Association of Scientific Hydrology Publication No 93, p 353-361, July 1970. 9 p, 6 fig, 2 tab, 14 ref.

Descriptors: *Water balance, *Profiles, *Latitudinal studies, *Hydrologic cycle, Summer, Winter, Land, Oceans, Orography, Moisture, Meteorology, Precipitation (Atmospheric), Runoff, Evaporation, Water storage, Surface waters, International Hydrological Decade.
Identifiers: *Meridional profiles, *Northern hemisphere.

Starting with reasonable estimates of meridional profiles of atmospheric moisture transport, storage on land, runoff, and evaporation, water balances have been completed to yield profiles of ocean and land precipitation and atmospheric moisture transport between land and sea for winter and summer. Precipitation profiles from land are compared with those from the ocean to illustrate effects of orography and moisture limitations. Profiles of moisture exchange between land and sea suggest that land is the predominant moisture source during summer and that the atmospheric arm of the hydrologic cycle is reversed during this season. (Woodard-USGS)
W71-02789

WATER BALANCE IN ANGOLA FOR THE DECADE 1958/1968,
Carlos Quintela Gois.
In: Symposium on World Water Balance, Vol 2, International Association of Scientific Hydrology Publication No 93, p 342-352, July 1970. 11 p, 3 fig, 4 tab.

Descriptors: *Water balance, *Synoptic analysis, *Foreign projects, International Hydrological Decade, Precipitation (Atmospheric), Flow rates, Meteorology, Hydrologic data, Hydrologic cycle, Hydrologic budget, Runoff, Streamflow, Water storage, Reservoirs.
Identifiers: *Angola (Africa).

Formulas relating precipitation with flow deficit for determining water balance in Angola (Africa) are presented. The water balance is examined in basins covering approximately 40% of the Province and the results obtained are extended to the remaining area. The total water balance is still calculated in basins draining to the Atlantic Ocean and neighboring countries. (Woodard-USGS)
W71-02790

DATA FOR THE STUDY OF THE WATER BALANCE IN SPAIN (IN FRENCH),
For primary bibliographic entry see Field 07C.
W71-02791

WATER RESOURCES AND WATER BALANCE OF THE USSR,
State Hydrological Inst., Leningrad (USSR).
A. P. Bochkov, A. I. Chebotarev, and K. P. Voskresensky.
In: Symposium on World Water Balance, Vol 2, International Association of Scientific Hydrology Publication No 93, p 324-330, July 1970. 7 p, 6 ref.

Descriptors: *Water balance, *Water resources, *Synoptic analysis, Foreign projects, Surface waters, Mathematical studies, Equations, Meteorology, Hydrologic cycle, Hydrologic budget, Precipitation (Atmospheric), Vegetation, Runoff, Streamflow, Water storage, International Hydrological Decade.
Identifiers: *USSR.

Information on water balance, formation of water balance components, methods for water balance computation, and the amount of surface water in the USSR is presented. Total storage of fresh surface water of the USSR, on the basis of available data, slightly exceeds 45,000 cubic km; one half of it is in the Baikal Lake. The annual recharge of water (river runoff in the USSR) is about 10% of the total surface water storage of the Soviet Union. Its total amount and distribution is determined by peculiarities of climate, transfer of humid air masses from the ocean to the land, and the amount of precipitation and losses by evaporation. Topography and other geographical factors affect greatly the distribution of water resources over territory. (Woodard-USGS)
W71-02792

CATCHMENT EVAPORATION AS MANIFESTED IN CLIMATOLOGIC OBSERVATIONS,
Dept. of Energy, Mines and Resources, Ottawa (Ontario). Hydrologic Sciences Div.
For primary bibliographic entry see Field 02D.
W71-02793

MONTHLY WATER BALANCE IN TRIBUTARY WATERSHEDS OF THE GREAT LAKES SAINT LAWRENCE RIVER BASIN AS INFLUENCED BY CLIMATIC FACTORS,
Catholic Univ. of America, Washington, D.C. Dept. of Civil Engineering.
Boris S. Browzin.
In: Symposium on World Water Balance, Vol 2, International Association of Scientific Hydrology Publication No 93, p 479-493, July 1970. 15 p, 7 fig, 4 tab, 6 ref.

Descriptors: *Water balance, *Great Lakes, *Climatic data, Monthly, Watersheds (Basins), Hydrologic budget, Hydrologic cycle, Mathematical studies, Equations, Hydrologic data, Meteorological data, Precipitation (Atmospheric), Runoff, Evaporation, International Hydrological Decade.
Identifiers: *St. Lawrence River basin.

The type of hydrology generated by tributaries to the Great Lakes and to the St. Lawrence River is the product of the climate dominating the tributary watersheds which is best evident by studying small watersheds. Four basins located in essentially different climatic conditions were selected: two with snow-type hydrology, one in continental climate, and the other in oceanic. Two basins with pluvial-snow hydrology were selected. Calculation of the balance was made by determining three components independently: precipitation, runoff, and evaporation. The validity for this type of calculation was evaluated. Related graphs and tables of data are presented. (Woodard-USGS)
W71-02795

THE REGULARITIES OF LONG-TERM FLUCTUATIONS OF STREAMFLOW AS A COMPONENT OF THE WATER BALANCE,
S. N. Kritsky, and M. F. Menkel.
In: Symposium on World Water Balance, Vol 2, International Association of Scientific Hydrology Publication No 93, p 494-501, July 1970. 8 p, 2 fig, 17 ref.

Descriptors: *Water balance, *Synoptic analysis, *Streamflow, *Flow rates, Hydrologic cycle, Hydrologic budget, International Hydrological Decade, Foreign projects.
Identifiers: *USSR.

Results of studying the regularities of fluctuations of water-balance components are discussed. Emphasis is placed on streamflow fluctuations. In long-term fluctuations studies, three principal directions are traced: (a) investigations of distribution of streamflow values probability; (b) investigations of groupings of wet and dry years and stipulating correlations; and (c) revealing cycles and trends in the process of hydrological phenomena. (Woodard-USGS)
W71-02796

HYDROLOGIC BUDGET OF NORTH AMERICA AND SUB-REGIONS FORMULATED USING ATMOSPHERIC VAPOR FLUX DATA,
Connecticut Univ., Storrs. Dept. of Civil Engineering.
For primary bibliographic entry see Field 02B.
W71-02797

DEVELOPMENT OF THE WATER RESOURCES AS A FUNCTION OF THE NATURAL RHYTHMICAL PHENOMENA,
Akademiya Nauk SSSR, Leningrad.
A. V. Shnitnikov.
In: Symposium on World Water Balance, Vol 2, International Association of Scientific Hydrology Publication No 93, p 530-537, July 1970. 8 p, 3 fig, 14 ref.

Descriptors: *Water resources, *Earth (Planet), *Gravimetry, *Natural resources, Forecasting, Hydrologic budget, Hydrologic cycle, Synoptic analysis, Climatology, Meteorology, Water storage, Precipitation (Atmospheric), Moisture, International Hydrological Decade, Foreign projects.
Identifiers: *Natural rhythmical phenomena, USSR.

Contemporary conditions of global water resources are related to the natural rhythmical phenomena of the earth to predict water resources of the future. Along with rather intricate pictures of interacting rhythms in nature (climatic, geophysical, hydrological, etc. and biological--in the flora and fauna) there exist rhythms manifesting themselves systematically and distinctly. The rhythm of gravitational force inequalities of somewhat less than 2000 year period of duration is most representative for the present. From basic trends of natural development of some major components of the Northern Hemisphere continents, the water resources for the next one or two centuries appear adverse. (Woodard-USGS)
W71-02798

WATER BALANCE PECULIARITIES OF KARST AREAS,
State Hydrological Inst., Leningrad (USSR).
For primary bibliographic entry see Field 02F.
W71-02799

ANNUAL WATER LOSSES IN THE CEYHAN BASIN, TURKEY,
Huseyin Conturk.
In: Proceedings of Central Treaty Organization Seminar on Evaluation of Water Resources With Scarce Data, March 4-8, 1969, Tehran, Iran, p 263-267, January 1970. 5 p, 1 tab, 8 ref.

Descriptors: *Water resources, *Water loss, *River basins, *Foreign projects, Runoff, Precipitation (Atmospheric), Maps, Hydrologic data, Streamflow, Watershed management.
Identifiers: *Ceyhan River Basin (Turkey).

Annual water losses over the Ceyhan Basin are calculated, utilizing the annual precipitation map and runoff records. Results are presented in a map consisting of iso-lines of water loss in milimeters. With the aid of precipitation and water loss maps annual runoff depths can be estimated in areas or subbasins where direct information on runoff does not exist or is rather poor. Information presented on water losses may find a direct usage also, such as in evaluating climatic features. Since water loss, together with precipitation and runoff, makes up the water budget, the water loss map of the Ceyhan Basin can obtain a better usage when coordinated with precipitation and runoff maps. (Woodward-USGS)
W71-02813

THE ESTIMATION OF FACTORS CONTROLLING STREAMFLOW IN AREAS WITH LIMITED DATA,
Institute of Hydrology, Wallingford (England).
For primary bibliographic entry see Field 02E.
W71-02818

APPLICATION OF SOME EMPIRICAL METHODS IN THE STUDY OF EVAPOTRANSPIRATION IN IRAN,
Institute of Hydro-Sciences and Water Resources Technology, Tehran (Iran).
For primary bibliographic entry see Field 02D.
W71-02819

MINIMAL DATA GATHERING PROCEDURE,
West Pakistan Water and Power Development Authority, Lahore.
For primary bibliographic entry see Field 07A.
W71-02823

EVALUATION OF WATER RESOURCES WITH SCARCE DATA.
Central Treaty Organization.

Proceedings of Central Treaty Organization Seminar, March 4-8, 1969, Tehran, Iran, 1970. 501 p.

Descriptors: *Water resources, *Hydrologic data, *Evaluation, Surface waters, Groundwater, Water quality, Streamflow, Floods, Droughts, Watershed management, Water tables, Meteorological data, Network design, Computers, Mathematical models, Reviews, Dam design, Reservoir design, Maps, Hydrographs, Sedimentation.
Identifiers: *Scarce data, Project activities, Empirical formulas, Probability curves.

This collection includes 33 papers that were presented at the Central Treaty Organization Seminar in Tehran, Iran, March 4 to 8, 1969. Countries represented on the program were Iran, Pakistan, Turkey, United Kingdom, and the United States. The reports are grouped into the following headings: Hydrological Characteristics of CENTO Countries; Data with Duration Limitation; Data with Aerial Limitation; and Data with Subject Limitation. Scarce data as applied to hydrological information can mean a degree of scarcity, as time passes new patterns of record will occur, trends will be noted and new extreme values will be obtained. Scarcity will continue because the record is always unfolding and as the length of record grows so the future predictions based upon it should become more precise. Many expedients are described in the papers to make scarce data applicable to the current problems. Emphasis is placed on mathematical analysis of scarce data and reviews for helping solve problems in water balance and watershed management. (Lang-USGS)
W71-02824

WATER UTILIZATION ASPECTS OF WEATHER MODIFICATION AS APPLIED TO KANSAS,
Kansas Water Resources Research Inst., Manhattan.
For primary bibliographic entry see Field 03B.
W71-02827

CLIMATES OF WEST PAKISTAN ACCORDING TO THORNTHWAITE'S SYSTEM OF CLASSIFICATION OF CLIMATES,
Nasrullah Khan.
Pakistan Geographical Review, Vol 23, No 1, p 12-36, January 1968. 12 fig, 1 tab, 7 ref.

Descriptors: *Arid lands, *Climatic zones, *Regional analysis, *Evapotranspiration, Planning, Mapping, Distribution patterns, Data collections, Evaluation, Precipitation (Atmospheric), Water analysis, Water demand, Water resources, Water supply, Water yield, Seasonal, Temperature, Classification, Surplus water, Moisture deficit, Climatic data, Humidity.
Identifiers: *West Pakistan, *Potential Evapotranspiration, *Thermal efficiency, *Climatic classification types.

Annual precipitation is variable and inadequate in West Pakistan and it is therefore important for planning purposes to estimate water need, water surplus and water deficits. Thornthwaite's climatic classification system has been adopted because it yields approximate values of potential evapotranspiration (PE), actual evapotranspiration, water surplus and water deficiency. Additionally, it is independent of vegetation zones, since only available precipitation and temperature data are needed. From calculated data, country-wide charts are presented of annual precipitation, annual and seasonal PE, annual water deficiencies and surpluses, moisture regions, thermal efficiency, seasonal variation of effective moisture and climatic types. In general the seasonal march of PE is uniform with low lying desert areas being the regions of lowest PE, and mountainous areas have the highest PE. Although evapotranspiration and precipitation are independent climatological events, the former is a function of both temperature and relative humidity. The PE of an arid region is therefore usually great because of a general lack of cooling and humidifying effects. Regional thermal efficiencies and climatic classification and the areas of seasonal or annual water deficits are described. (Casey-Arizona)
W71-02869

A PRACTICAL GUIDE TO WATER QUALITY STUDIES OF STREAMS,
Federal Water Quality Administration, Cincinnati, Ohio. National Field Investigations Center.
F. W. Kittrell.
For sale by Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402. Price $0.70. SOD No 167.8:ST8. Available at NTIS as PB-196 367, $0.95 in microfiche. Federal Water Pollution Control Administration Clean Water Report CWR-5, 1969. 135 p, 10 fig, 43 ref, append.

Descriptors: *Water quality, *Water analysis, *Analytical techniques, Streams, *Data collections, *Sampling, Methodology, Evaluation, Water pollution sources, Water supply, Water users, Chemical analysis, Biological properties, On-site tests, Laboratory tests, Data processing, Path of pollutants.
Identifiers: *Water quality studies, Report preparation.

A general guide for studying water quality of streams is presented. Specific procedures peculiar to stream pollution studies are dealt with at some length. General principles and techniques rather than exact methodology are covered. For example, various techniques are given by which time-of-water travel may be measured, rather than an exact description of dye-concentration measurement. Each chapter, except the last, is devoted to a single factor, principle or procedure involved in studies of water quality. One chapter, for example, deals with objectives of stream studies. It lists some of the reasons for conducting studies and discusses the importance of careful and thorough delineation of the objectives of a particular study before it starts. Another chapter has suggestions for preparation of a report on water quality. The last chapter suggests an orderly sequence for the conduct of stream studies. It attempts to wrap the essence of the preceding chapters in one package, without excessive repetition. The material is limited to information that is not ordinarily found in textbooks and technical articles. (Woodard-USGS)
W71-02885

OBSERVATIONS OF DEEP-WATER RENEWAL IN THE CARIBBEAN SEA,
Rhode Island Univ., Kingston. Graduate School of Oceanography.
Wilton Sturges.
Journal of Geophysical Research, Vol 75, No 36, p 7602-7610, December 20, 1970. 9 p, 6 fig, 15 ref.

Descriptors: *Mixing, *Sea water, *Currents (Water), Tides, Water circulation, Salinity, Water temperature, Current meters, Data collections.
Identifiers: *Caribbean Sea, *Venezuela basin.

Observations with bottom-moored current meters in the Jungfern passage show that deep water in the Venezuela basin in being renewed. During a 5-day record, the flow was mainly oscillatory at tidal frequency, with a net inflow by the tidal mechanism of only 6,000 cu m per sec. During a single 11-hour surge the inflow rate was 50 to 200 thousand cu m per sec. Steady-state heat-budget and oxygen-budget calculations require a renewal rate of about 100,000 cu m per sec. The sill depth is 1860 meters. Observations near the sill reveal a sharp interface between Caribbean water above and oceanic water below sill depth. The north-south hydrographic sections of IGY data show an abrupt change in vertical temperature gradient near 2600 to 2800 meters. This feature, also found in other basins, is interpreted to result from differences in renewal between tidal inflow and stronger sporadic surges, with the earth's rotation being an important controlling parameter. (Knapp-USGS)
W71-02897

METHODS FOR THE STUDY OF WATER BALANCE OF IRRIGATED LANDS AND IRRIGATION SYSTEMS,
State Hydrological Inst., Leningrad (USSR).
For primary bibliographic entry see Field 03F.
W71-02910

OBJECTIVE STATISTICAL METHODS OF COMPUTATION AND GENERALIZATION OF THE PARAMETERS OF MAXIMUM RAINFALL RUNOFF,
State Hydrological Inst., Leningrad (USSR).
G. A. Alexeyev.
In: Floods and Their Computation, Vol 1, International Association of Scientific Hydrology Publication No 84 (Unesco-WMO), p 114-127, 1969. 14 p, 4 tab, 4 ref.

Descriptors: *Rainfall-runoff relationships, *Statistical methods, *Reviews, Probability, Hydrograph analysis, Routing, Frequency analysis, Parametric hydrology, Statistical models, Analytical techniques.
Identifiers: USSR.

Because rain precipitation falls rather irregularly both in time and in space, statistical methods of analyzing rainfall-runoff relations are used in the USSR. These statistical methods are critically reviewed. Daily amounts of rainfall and amounts for ten-day periods are measured rather inaccurately by existing rain gage networks with a mean standard error of about 50-100%. Data on rainfall of certain exceedence probability may be obtained with reasonable reliability providing that they are averaged in time and space. (Knapp-USGS)
W71-02936

ON THE METHOD OF UNIT HYDROGRAPH AND MODELLING OF RAINFALL FLOODS BY ELECTRONIC ANALOGUE COMPUTERS,
State Hydrological Inst., Leningrad (USSR).
D. L. Sokolovsky.
In: Floods and Their Computation, Vol 1, International Association of Scientific Hydrology Publication No 84 (Unesco-WMO), p 205-213, 1969. 9 p, 3 fig, 1 tab, 11 ref.

Descriptors: *Unit hydrographs, *Analog models, *Rainfall-runoff relationships, *Flood forecasting, Runoff forecasting, Model studies, Hydrograph analysis, Duration curves, Routing, Peak discharge, Discharge (Water).
Identifiers: Isochrone theory, Rainfall floods.

On the basis of the isochrone theory the method of unit hydrographs is used to solve some problems regarding unit-hydrograph elements depending on design time unit and rainfall duration. The method is applied to rivers with different catchment areas. In addition, the technique of electronic analog modelling machines for computation of rainfall flood hydrographs is discussed. The technique has shown the efficiency of modelling of floods of any kind and shape for different catchment areas with considerable speed and computation accuracy. (Knapp-USGS)
W71-02944

COMPUTATION PRINCIPLES OF FLOOD HYDROGRAPHS,
State Hydrological Inst., Leningrad (USSR).
K. P. Voskresensky.
In: Floods and Their Computation, Vol 1, International Association of Scientific Hydrology Publication No 84 (Unesco-WMO), p 213-219, 1969. 7 p, 7 ref.

Descriptors: *Hydrograph analysis, *Flood forecasting, Rainfall-runoff relationships, Analog models, Unit hydrographs, Model studies, Floods, Discharge (Water), Peak discharge.
Identifiers: Flood hydrographs.

In practice while choosing a design flood hydrograph it is expedient to consider only the main elements of the flood wave shape: runoff volume, duration and maximum discharge. Modelling of a flood hydrograph can be performed as follows: (1) On the base of schematic geometric figures; (2) By means of type equation of flood wave; (3) On the basis of an actual flood selected from previously observed floods; (4) With the use of the averaged hydrograph of some typical floods for a given river; (5) On the basis of the unit hydrograph; (6) By means of the hydrograph of an analogous river; (7) On the basis of electrodynamic analogy. In selection of design hydrograph the following must be kept in mind: (1) The genetic conditions of flood formation (floods caused by rainfall, snowmelt, melting of glaciers and floods of mixed type); (2) The flood wave shape (with one or more crests) typical for a given river; (3) Flood origin (natural, artificial reservoir release, dambreak etc.). In addition account must be taken of the given limiting conditions such as maximum discharge or flood volume, the shortest duration at a given runoff volume etc. The optimum model is chosen depending on the particular problem, be it flood control or the passing of flood through hydraulic structures. (Knapp-USGS)
W71-02945

ANNOTATED BIBLIOGRAPHY OF REPORTS, STUDIES, AND INVESTIGATIONS RELATING TO SATELLITE HYDROLOGY,
National Environmental Satellite Center, Washington, D.C.
D. R. Baker, A. F. Flanders, and M. Fleming.
Available from NTIS as PB-194 072, $3.00 in paper copy, $0.95 in microfiche. Essa Technical Memorandum NESCTM10, July 1970. 28 p.
Identifiers: *Hydrology, *Bibliographies, *River basins, *Spaceborne photography, Meteorological satellites, Snow cover, Ice reporting, Remote sensing, Photogrammetry.

The objective of this program is to develop applications of satellite data to hydrologic problems confronting ESSA's mission. In the course of this activity considerable literature has been reviewed and the following annotated bibliography includes the 115 papers and reports deemed to be of importance to the program.
W71-02955

THE WATER ENCYCLOPEDIA.
California Univ., Berkeley. Dept. of Civil Engineering.
For primary bibliographic entry see Field 07C.
W71-03116

SPURIOUS CYCLES IN WATER RESOURCES SYSTEMS,
Kansas State Univ., Manhattan. Dept. of Economics.
For primary bibliographic entry see Field 06A.
W71-03124

2B. Precipitation

PRECIPITATION AND EVAPORATION-THEIR PRACTICAL AND OPERATIONAL ASPECTS FOR THE WATER CYCLE BALANCE,
World Meteorological Organization, Geneva (Switzerland). Div. of Hydrometeorology.
Jaromir Nemec.
In: Symposiim on World Water Balance, Vol 1, International Association of Scientific Hydrology Publication No 92, p 193-199, July 1970. 7 p, 15 ref.

Descriptors: *International hydrological decade, *Reviews, *Water balance, *Precipitation (Atmospheric), *Evapotranspiration, Stations, Economics, Meteorology, Programs, Project planning.
Identifiers: *World Meteorological Organization.

The work of the World Meteorological Organization includes operational and practical activities connected with the assessment of precipitation and evaporation processes. These efforts are divided into four components: international standardization and intercomparison of instruments and methods of observation, use of advanced technology for monitoring of data in the WMO system of the World Weather Watch, technical assistance to developing countries in water balances of their catchments and guidance on operational techniques of water balance calculation. (Knapp-USGS)
W71-02775

ESTIMATION OF PRECIPITATION AS WATER BALANCE ELENENT,
State Hydrological Inst., Leningrad (USSR); and Main Geophysical Observatory, Leningrad (USSR).
A. P. Bochkov, and L. R. Struzer.
In: Symposium on World Water Balance, Vol 1, International Association of Scientific Hydrology Publication No 92, p 186-193, July 1970. 8 p, 16 ref.

Descriptors: *Precipitation gages, *Rain gages, *Calibrations, *Instrumentation, Sampling, Winds, Gaging stations, Rainfall disposition.
Identifiers: USSR.

Precipitation gages underestimate precipitation because of wind influence, losses of precipitation on moistening of the raingage bucket, and evaporation. In 1961 the Hydrometeorological Service of the USSR started experimental study of the errors of various standard precipitation gages. The greatest errors and the most difficult to estimate appeared to be the errors caused by the wind effect. From the physical point of view it is clear that the value of the error depends on the wind speed at the height of the receiver and on the precipitation structure (the size of raindrops and snow-flakes). Systematic errors of simple pit raingages, including the effects of splashing, do not exceed 1.5%. On the basis of investigations of precipitation measurement errors a system of correcting long-term average monthly, seasonal and annual precipitation values, precipitation values of individual months, and measured precipitation values for observation terms on meteorological stations and posts was developed. (Knapp-USGS)
W71-02776

ON THE QUESTIONS OF RAINFALL MEASUREMENT AND REPRESENTATIVENESS,
Hydrological Research Unit, Wallingford (England).
John C. Rodda.
In: Symposium on World Water Balance, Vol 1, International Association of Scientific Hydrology Publication No 92, p 173-186, July 1970. 14 p, 9 fig, 4 tab, 34 ref.

Descriptors: *Rain gages, *Calibrations, *Instrumentation, Network design, Sampling, Precipitation gages, Winds, Gaging stations, Rainfall disposition.
Identifiers: United Kingdom.

Conventional types of raingage, with orifices between 30.5 cm and 2 m above ground level, suffer from several sources of error, chiefly wind. These combine to make the catch of a gage systematically less than the quantity of rain that would otherwise reach the ground in the absence of that gage. Errors resulting from evaporation, splash-out and similar causes are usually minimized by the design of the gage, but no gage yet constructed overcomes the effect of the wind. Its influence can be lessened, however, by the use of shields, turf walls, and similar devices, but the most satisfactory way of mitigating the effect of wind is to install the gage in a pit with its rim at ground level, covering the pit with a splash-inhibiting surface. Results from ground level raingages are being collected at a number of sites in the United Kingdom. In small, wind-swept basins, raingages installed level with the ground produce the more realistic and representative measurements than elevated gages. For these conditions a single weekly gage may be adequate to sample areas 1 km across. (Knapp-USGS)
W71-02777

SIMULATION OF THE HYDROLOGIC CYCLE OF THE GLOBAL ATMOSPHERIC CIRCULATION BY A MATHEMATICAL MODEL,
Environmental Science Services Administration, N. J., Geophysical Fluid Dynamics Lab.
For primary bibliographic entry see Field 02A.
W71-02782

A STUDY OF THE ATMOSPHERIC HEAT AND MOISTURE BUDGET BETWEEN EQUATOR AND 60 DEG N DURING THE WINTER AND SUMMER SEASONS,
Wisconsin Univ., Madison.

Stefan Hastenrath.
In: Symposium on World Water Balance, Vol 2, International Association of Scientific Hydrology Publication No 93, p 415-421, July 1970. 7 p, 4 tab, 9 ref.

Descriptors: *Heat budget, *Water vapor, *Atmosphere, *Latitudinal studies, *Synoptic analysis, Winter, Summer, Hydrologic cycle, Climatic data, Meteorological data, Equations, Latent heat, Evapotranspiration, International Hydrological Decade.
Identifiers: *Meridional circulation, *Equator to 60 degrees N, Troposphere, Sensible heat, Potential energy.

On the basis of seasonal mean data, the divergence of the flux of latent heat, potential energy, andsensible heat is computed for the layer 1000-100 mb and 10 deg latitude belts between Equator and 60 deg N. The magnitude of latitude-mean evapotranspiration resulting from the latent heat budget is realistic. Similarly, the budget of sensible heat and potential energy for the entire tropospheric column is compared with latitude-mean estimates of diabatic heat sources and sinks available in the literature. Within the tropics, the mean meridional circulation is the major agent for the meridional transport of heat and moisture. (Woodard-USGS)
W71-02783

SOME MEASUREMENTS OF THE MERIDIONAL FLUX OF WATER VAPOR ACROSS 30 DEG N,
British Meteorological Office, Brackwell (England).
R. Murray.
In: Symposium on World Water Balance, Vol 2, International Association of Scientific Hydrology Publication No 93, p 376-386, July 1970. 11 p, 4 fig, 1 tab, 10 ref.

Descriptors: *Water vapor, *Measurement, *Latitudinal studies, *Atmosphere, *Synoptic analysis, Moisture, Climatic data, Meteorological data, Hydrologic data, Equations, Monsoons, Eddies, Climatic zones, Summer, Winter, Land, Oceans, Moisture content, Circulation, International Hydrological Decade.
Identifiers: Thirtieth parallel N, *Aerological cross-sections.

Computations of meridional transport of water vapor across 30 deg N were made for March, June, September and December 1958, based on data extracted from daily aerological cross-sections. In all months the total flux of moisture is directed northwards. In summer the flux is about twice as great as in winter. Seasonal difference in total flux appears to be mainly due to contributions from standing eddy flux of moisture associated with summer monsoons. The transient eddy flux of moisture, associated with synoptic-scale disturbance, is greater in winter than in summer. The transient eddy flux is directed northwards in all months. The mean circulation flux associated with the tropical Hadley cell is generally about the same magnitude as other components but directed equatorwards. Seasonal changes in position and intensity of main concentrations of meridional transport of water vapor are discussed. (Woodard-USGS)
W71-02784

COMPARATIVE HEAT BALANCE CALCULATIONS - FIRST RESULTS OF A GLOBAL INVESTIGATION,
Bonn Univ., (Western Germany).
D. Henning.
In: Symposium on World Water Balance, Vol 2, International Association of Scientific Hydrology Publication No 93, p 361-376, July 1970. 16 p, 5 fig, 14 ref, append.

Descriptors: *Heat balance, *Water balance, *Latitudinal studies, *Earth (Planet), Hydrologic data, Equations, Hydrologic cycle, Meterology, Precipitation (Atmospheric), Climatic data, Meteorological data, Air temperature, Humidity, Vapor pressure, Cloud cover, Solar radiation, Oceans, Orography, International Hydrological Decade.

Climatological data, including cloud cover and humidity, are evaluated by three methods in determining the global balances of heat and water. Emphasis is on the method of the late German meteorologist, Fritz Albrecht, who published data on global heat and water balance figures for oceans and continents. His results concerning the ocean, processed into time latitude cross-sections, and computations of the budget terms for North America and Northern Asia are presented. Five essential zones of evaporation minus precipitation are distinguished year round above the ocean. The meridional gradient of this quantity is twice as strong above the northern as above the southern hemisphere ocean. (Woodard-USGS)
W71-02788

MERIDIONAL PROFILES OF THE NORTHERN HEMISPHERE WATER BALANCE,
Nevada Univ., Reno. Desert Research Inst.
For primary bibliographic entry see Field 02A.
W71-02789

WATER BALANCE IN ANGOLA FOR THE DECADE 1958/1968,
For primary bibliographic entry see Field 02A.
W71-02790

MONTHLY WATER BALANCE IN TRIBUTARY WATERSHEDS OF THE GREAT LAKES SAINT LAWRENCE RIVER BASIN AS INFLUENCED BY CLIMATIC FACTORS,
Catholic Univ. of America, Washington, D.C. Dept. of Civil Engineering.
For primary bibliographic entry see Field 02A.
W71-02795

HYDROLOGIC BUDGET OF NORTH AMERICA AND SUB-REGIONS FORMULATED USING ATMOSPHERIC VAPOR FLUX DATA,
Connecticut Univ., Storrs. Dept. of Civil Engineering.
G. P. Malhotra, and P. Bock.
In: Symposium on World Water Balance, Vol 2, International Association of Scientific Hydrology Publication No 93, p 501-524, July 170. 24 p, 14 fig, 4 tab, 25 ref.

Descriptors: *Hydrologic budget, *Water vapor, *Atmosphere, *Water balance, Hydrologic cycle, Hydrologic data, Climatic data, Meteorological data, Precipitation (Atmospheric), Evapotranspiration, Surface waters, Groundwater, Water storage, Equations, International Hydrological Decade.
Identifiers: *North America, *Subregions.

The atmospheric water vapor flux divergence has been computed to obtain water balances of parts of North America for the period May 1, 1958 to April 30, 1963. Eleven areas were studied ranging in size from 8.5 million square kilometers (3.3 million square miles) to 150,000 square kilometers (58,000 square miles). The data included mean-monthly vertically-integrated distribution of flux divergence and precipitable water, regional averages of runoff, and isohyetal averages of precipitation. The atmospheric data were used to estimate the mean difference between precipitation and evapotranspiration. These values further yielded values of mean monthly evapotranspiration, and indirectly yielded mean monthly change in the surface and subsurface water storage, and the yearly pattern of the cumulative storage. The results of the study indicate that the patterns of monthly evapotranspiration and storage as computed from atmospheric data become questionable if the size of area is reduced below about 550,000 square kilometers (200,000 square miles). (Woodard-USGS)
W71-02797

MAXIMUM ONE DAY FALLS OF PRECIPITATION IN TEHRAN,
United Nations Development Program, Tehran (Iran).
A. H. Gordon, and J. G. Lockwood.
In: Proceedings of Central Treaty Organization Seminar on Evaluation of Water Resources With Scarce Data, March 4-8, 1969, Tehran, Iran, p 467-470, January 1970. 4 p, 2 tab, 2 ref.

Descriptors: *Precipitation (Atmospheric), *Forecasting, *Hydrologic data, *Statistical methods, *Foreign projects, Equations, Topography, Floods, Mountains, Planning.
Identifiers: *Tehran (Iran), Seasonal precipitation, Historic records.

Certain parts of Tehran are vulnerable to flooding when the drainage facilities are overtaxed with excessive runoff from higher slopes. The winter precipitation may be largely snow, particularly in the mountains behind Tehran. The runoff will therefore be slow. In spring the freezing level may be much higher and there is a danger of rapid runoff and floods. Rainfall data since 1898 are used with related factors for analysis of maximum one-day precipitation falls. Factors considered include mean monthly precipitation; monthly median for maximum one-day falls; records of the maximum rainfall in one day for winter and spring respectively; rainfall values likely to be equalled or exceeded in given return period during winter and spring; mean annual precipitation; and, relation between elevation and rainfall. Mean annual precipitation for the city is about 200 mm, but much larger amounts occur over the Elburz mountains to the north and bare slopes are conductive to rapid runoff and periodic flooding. (Woodard-USGS)
W71-02801

A STATISTICAL ANALYSIS OF THE ANNUAL, MONTHLY AND DAILY PRECIPITATION OF TEHRAN,
Fereidoon Hashemi.
In: Proceedings of Central Treaty Organization Seminar on Evaluation of Water Resources With Scarce Data, March 4-8, 1969, Tehran, Iran, p 439-466, January 1970. 28 p, 5 fig, 10 tab, 2 ref.

Descriptors: *Precipitation (Atmospheric), *Forecasting, *Statistical methods, *Foreign projects, Equations, Probability, Hydrographs, Annual, Monthly.
Identifiers: *Tehran (Iran), *Historic data, Cumulative probabilities, Daily rainfall records.

Methods of statistical analysis of the precipitation record of Tehran, Iran (35 deg 41'N latitude and 51 deg 19'E longitude) are presented along with the resulting tables and graphs on the probabilities of annual, monthly and daily precipitation. Precipitation was analyzed as a whole and no attempt was made to break it down into snow, ice, and rain. Daily precipitation records of Tehran from 1898 through 1967 were used in this project. Computations indicate that the annual precipitation follows the Gaussian distribution with 99% certainty. The largest portion occurs in the November to April period during which time 81% of the total precipitation occurs. Probability of receiving more than 35 mm in a single day is never more than 5%. This amount over a 24 hour period does not cause flood damage. (Woodard-USGS)
W71-02802

RAINFALL FREQUENCY ATLAS OF TURKEY,
State Hydraulics Works, Ankara (Turkey). Hydrology Section.
Samim Oztek.
In: Proceedings of Central Treaty Organization Seminar on Evaluation of Water Resources With Scarce Data, March 4-8, 1969, Tehran, Iran, p 167-169, January 1970. 3 p, 2 fig, 8 ref.

Descriptors: *Rainfall, *Frequency analysis, Rain gages, Probability, Statistical methods, Distribution patterns, Maps, Foreign projects.
Identifiers: *Hydrologic Atlas, *Turkey.

Frequency analysis of approximately 500 point rainfall values having 10 or more years record were used in the preparation of this Atlas. Rainfall-frequency data cover durations from 1 hour to 24 hours and return periods from 2.33 to 100 years. Methods used in compiling data are described. Data and locations of stations are plotted on a 1:2 250,000 scale map of Turkey. (Woodard-USGS)
W71-02820

THE DROUGHTS OF ANTIGUA,
Halcrow (William) and Partners, London (England).
For primary bibliographic entry see Field 02E.
W71-02822

MERCURY IN THE ATMOSPHERE,
Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 05B.
W71-02894

ATMOSPHERIC AND FLUVIAL TRANSPORT OF MERCURY,
Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 05B.
W71-02895

TRITIUM FALLOUT IN THE PACIFIC UNITED STATES,
California Univ., Los Angeles. Dept. of Chemistry.
For primary bibliographic entry see Field 02K.
W71-02898

TRITIUM PROFILE AT THE NORTH PACIFIC (1969) GEOSECS INTERCALIBRATION STATION,
For primary bibliographic entry see Field 02K.
W71-02900

SIGNIFICANCE OF CAMILLE (1969),
Florida State Univ., Tallahassee. Dept. of Geology.
William F. Tanner.
Southeastern Geology, Vol 12, No 2, p 95-103, November 1970. 9 p, 1 fig, 15 ref.

Descriptors: *Hurricanes, *Florida, *Damages, *Waves (Water), Floods, Wind velocity, Beach erosion, Beaches, Gulf of Mexico, Mississippi, Sea walls, Coasts, Shore protection.
Identifiers: *Hurricane Camile (1969).

Hurricane Camille (1969) crossed the Mississippi-Louisiana coast as the most destructive tropical storm ever to strike the United States mainland. Because of the shape of the coast and the wind pattern destructive waves could come only from the east. Most of the damage was done by waves advancing toward the west. The maximum surface wind velocity was close to 265 km/hr, the storm tide was 6 to 7 meters, and the probable maximum wave height was about 10 meters above still water. Despite the large destruction of coastal property, the mainland beach and sea-wall were damaged little or not at all. This may have been due to the fact that the pre-storm nearshore slope of the bottom was only about two m/km. Camille built no mainland beach ridges. A comparison of probable tide heights from several hurricanes indicates that Camille may have been the 20 to 70 year storm for the entire northern Gulf coast, or the 80 to 160 year storm for the Mississippi segment. (Knapp-USGS)
W71-02908

DESIGN RAINFALL CHARACTERISTICS OF THE USSR TERRITORY,
State Hydrological Inst., Leningrad (USSR).
For primary bibliographic entry see Field 02E.
W71-02935

OBJECTIVE STATISTICAL METHODS OF COMPUTATION AND GENERALIZATION OF THE PARAMETERS OF MAXIMUM RAINFALL RUNOFF,
State Hydrological Inst., Leningrad (USSR).
For primary bibliographic entry see Field 02A.
W71-02936

AGROCLIMATOLOGICAL STUDIES IN THE LEVANT,
Swedish Meteorological and Hydrological Inst., Stockholm.
C. C. Wallen.
Technical Report on a Study of Agroclimatology in Semi-arid and Arid Zones of the Near East. WMO Technical Note No 56. Agroclimatological Methods: Proceedings of the Reading Symposium, Natural Resources Research, Vol 7, p 225-233, UNESCO, 1968. 2 tab.

Descriptors: *Data collections, *Climatic zones, *Rainfall, *Evapotranspiration, *Dry farming, Regional analysis, Variability, Weather data, Temperature, Statistical methods, Arid climates, Semiarid climates, Environmental effects, Probability, Water balance, Altitude, Agronomy, Cultivation, Agriculture.
Identifiers: *Middle East, *Potential evapotranspiration, *Agroclimatology, *Climatic classification, Lebanon, Syria, Jordan, Iran, Iraq.

A pilot study was made to investigate basic climatic conditions for agriculture in Lebanon, Syria, Jordan, Iraq and Iran. Semiarid lands of the area are used for cereal and stock-raising and arid lands for stock-raising. Due to population pressures, good pastoral lands are being cultivated for cereal production with resulting declines in soil structure. Climatic classification was initially determined by classical methods using rainfall and temperature data. The limit for dry land farming is about 240 mm average annual rainfall with a 37 percent interannual variability, which corresponds to the border-line between arid and semiarid zones. The length of the season of reliable rainfall is also considered an important aridity condition. Although it is not a limiting factor in the region, temperature was used to classify 12 subregions because it is a dominant factor in type and variety of crop selection. Potential evapotranspiration (ETP) calculated from Penman's formula and estimated actual evapotranspiration were used to determine the true water balances. Comparing the classical and water balance approaches, 2 important conclusions emerged. (1) In large areas of similar ETP and soil conditions the degree of aridity is largely maintained by the amount and variability of rainfall. (2) The radiation term is more important than the aerodynamic term of Penman's formula. Temperature, rainfall, water balance and agricultural conditions are fairly homogeneous for each of the 12 subregions. (Casey-Arizona)
W71-02971

FAO/UNESCO/WMO AGROCLIMATOLOGY SURVEY OF A SEMI-ARID AREA IN WEST AFRICA SOUTH OF THE SAHARA,
Food and Agriculture Organization of the United Nations, Rome (Italy). Land and Water Development Div.
J. Cocheme.
Agroclimatological Methods; Proceedings of the Reading Symposium, Natural Resources Research, Vol 7, p 235-248, UNESCO, 1968.

Descriptors: *Rainfall, *Climatic zones, *Semiarid climates, *Data collections, *Evapotranspiration, Climatology, Ecotypes, Crops, Gradation, Environmental effects, Vegetation effects, Soil types, Variability, Isohyets, Temperature, Water balance, Drought resistance, Plant growth, Cotton, Soil moisture, Dry farming, Statistical methods, Photoperiodism, Growth rates, Cultivation, Sorghum, Fertility, Hydrologic budget, Maps, Histograms, Surveys, Moisture availability, Seasonal, Regional analysis.
Identifiers: *Africa, *Potential evapotranspiration, *Agroclimatology, *Reflection coefficient, Millet.

An agroclimatic analysis was made of a zone of sub-Saharan Africa between the Atlantic Ocean and the Chad-Sudan boundary, which is bordered on the north by desert and the south by humid savannah and forest. There is, therefore, a north-south gradient of steadily decreasing aridity. Solar radiation is constant and high, and summer rains peak in August. The climatic zonation is reflected in vegetative and edaphic zonation. The agriculture of the area separates cultivation and animal husbandry, and soil fertility is restored by natural fallow. Little or no use is made of intensification techniques. Improvements are planned on a large scale and therefore basic information on the environments is essential. Rainfall histograms and isohyets were constructed. There is little variation in rainfall day and therefore north-south gradients reflect increases in the number of rainy days. Potential evapotranspiration (E sub T) was calculated according to Penman's formula using a reflection coefficient of 0.25, and was also distributed zonally. Two maxima and 2 minima occur yearly with consequences for crop production. The duration and dates of occurrence of availability of water were determined at various levels of E sub T. A number of examples are given illustrating how ecotype adaptation to climate can be gauged by comparing climatic parameters with plant biological characteristics. (Casey-Arizona)
W71-02972

RAINFALL DISTRIBUTIONS AND SIMULATION MODELS,
University of New England, Armidale (Australia).
B. J. Phillips.
Australian and New Zealand Assoc For The Advancement of Sci, 41st Congress - Adelaide, Aug 1969. Section 8 - Mathematical Sciences. 26 p, 1 fig, 8 tab, 15 ref. 3 append.

Descriptors: *Simulation analysis, *Computers, *Rainfall, *Stochastic processes, Farm management, Time.
Identifiers: Historical records, Pearson curve analysis.

The basic aim was to investigate ways in which rainfall can be incorporated into simulation models. It was concerned essentially with stochastic specification of rainfall and was oriented particularly towards the generation of data for farm management decision problems. The general question of rainfall patterns was considered and led to an investigation of autocorrelations in an attempt to define a time period beyond which the occurence of rainfall can be considered a random process. Simulation of such processes based upon historical data and based on the fitting of probability density functions were looked at and suggested ways in which these functions could be incorporated into simulation models were given. Brief attention was given to the problem of generating rainfall patterns, and some tentative methods were suggested. Curves for quarterly rainfall data were written for an IBM 1620 computer to evaluate ordinates of the three types of Pearson curves analysis used. Simulation was viewed as a forward-looking process which had as its aim assisting the analysis of complex decision problems. The historical data used for estimation in the empirical portions of this paper consisted of 91 years' records from the Armidale recording station. (Kriss-Cornell)
W71-03071

CLOUDS AND PRECIPITATION IN THE TEXAS HIGH PLAINS,
Texas Tech Univ., Lubbock. Dept. of Geosciences; and Texas Univ., Austin. Atmospheric Science Group.
Donald R. Haragan, and Kenneth H. Jehn.
Water Resources Bulletin, Vol 6, No 6, p 893-906, November-December 1970. 14 p, 7 fig, 6 tab, 6 ref. Tex Water Dev Bd Grant IAC (68-69)-175

Descriptors: *Precipitation (Atmospheric), *Synoptic analysis, *Texas, *Water supply, Climatology, Weather, Meteorological data,

Meteorology, Weather data, Weather modification, Clouds.
Identifiers: *High Plains (Texas).

A study of the relationship among cloudiness, precipitable water vapor, stability and precipitation is presented for the Texas High Plains. During periods of above-normal rainfall, precipitation during late fall and winter is associated with stratification clouds which develop in conjunction with cyclonic activity. Spring and summer precipitation is most highly correlated with cumuliform clouds characteristic of convective activity. Wet periods are further characterized by atmospheric instability and above-normal amounts of precipitable water vapor and water-vapor flux. Dry periods are associated with atmospheric circulation patterns which either serve to cut off the supply of low-level moisture, produce subsidence and consequent atmospheric stability, or both. (Knapp-USGS)
W71-03128

2C. Snow, Ice, and Frost

CARBON DIOXIDE IN THE SURFACE WATER OF THE ICE-COVERED BERING SEA,
Alaska Univ., College. Inst. of Marine Science.
For primary bibliographic entry see Field 02K.
W71-03115

POSITION OF PERMAFROST BENEATH SMALL WATERCOURSES,
Cold Regions Research and Engineering Lab., Hanover, N.H.
Yu. V. Dmitriyev.
Available from NTIS as AD-711 929, $3.00 in paper copy, $0.95 in microfiche. Translation from Materialy VIII Vsesoyuznogo Mezhduvedomstvennogo Soveshchaniya Po Geokrilogiye, No 2, 1966.
Identifiers: *Permafrost, Measurement, *Rivers, Inland waterways, Temperature, Soil mechanics, Clay, Silt, Moisture, Thickness, Construction, USSR, Translations, Boreholes.

Taking into account the contradictory nature of existing points of view and the conclusions drawn concerning the position of permafrost beneath small watercourses, in the region of layout of the Izvestkovaya-Urga-Chegdomyn (southern zone of dissemination of permafrost in the Far East) a study was made of 50 small watercourses, both permanent and ephemeral, as well as runoff zones and water-intake canals. Data for more than 150 stations were considered. Computation formulas are proposed for determining the maximum depth of the upper permafrost boundary in places where watercourses flow.
W71-03190

ON THE MECHANISM OF NIVAL PROCESSES,
Cold Regions Research and Engineering Lab., Hanover, N.H.
B. P. Lyubimov.
Translation of: Podzemnyy Led, Part III, No 3, p 158-175, 1967. Available from NTIS as AD-711 879, $3.00 in paper copy, $0.95 in microfiche. CRREL Translation, 1970. 14 p, 5 fig, 9 ref.
Identifiers: *Snow, *Erosion, Freezing, Permafrost, Melting, Deposits, Penetration, Frost heave, Rock (Geology), Transport properties, Terrain, USSR, Translations, *Nival processes, Geomorphology, Slopes.

The 'nivation' concept ('nivation' from the Latin root 'nix' — snow) is understood as the geomorphological process of the formation of corrie-like recesses on the slopes in the places of occurrence of firms as a result of the disruption of rocks along the edges of the firms under the effect of physical erosion and the subsequent removal of the material with the aid of fine streams of meltwater. The first combines the processes of disruption in continuity of the rocks and the active preparation of the material for displacement. The first group includes the following processes: (1) microclimatic: the development of a low-temperature zone under the firm, with the retention of a layer of seasonally frozen ground and the upheaval of the cover of ever-frozen rocks. The second group of the processes combines the processes of transporting and depositing the material; as a result, we have the formation of nival deposits and nival relief forms.
W71-03192

2D. Evaporation and Transpiration

MAPPING POTENTIAL EVAPORATION FOR TROPICAL EAST AFRICA: THE ACCURACY OF PENMAN ESTIMATES DERIVED FROM INDIRECT ASSESSMENTS OF RADIATION AND WIND SPEED,
East African Agriculture and Forestry Research Organization, Muguga (Kenya).
T. Woodhead.
In: Symposium on World Water Balance, Vol 1, International Association of Scientific Hydrology Publication No 92, p 232-241, July 1970. 10 p, 2 tab, 15 ref.

Descriptors: *Evapotranspiration, *Meteorology, Data collections, Synoptic analysis, Clouds, Winds, Humidity, Meteorological data, Evaporation, Tropical regions, Solar radiation.
Identifiers: *Potential evaporation, Penman method, East Africa, Ugnada, Kenya, Tanzania.

In tropical East Africa, the largest contribution to the Penman estimate of potential evaporation is from the short-wave radiation term. Insolation is measured at some sites, but large areas are devoid of radiation-measuring stations. Within some of these areas there are civil airfields at which meteorological observers do record cloud amount, from which insolation estimates have been deduced. In evaluating the aerodynamic term, an approximate relationship between daily wind run and synoptic Beaufort-scale wind speeds has been established. Using these cloud and wind speed data, potential evaporation totals for an individual month or year may be respectively evaluated with errors of 18 and 15%; at stations equipped with pyrheliometers and recording anemometers, the corresponding error is 6.5%. Long-term mean potential evaporation rates, monthly and annual, may each be determined to within 15% from a twenty-year series of synoptic cloud and wind observations. Such estimates, although inaccurate, are of value to hydrologists and agriculturists when no other evaporation data are available. (Knapp-USGS)
W71-02771

METHODS FOR THE ESTIMATION OF EVAPORATION FROM LAND, APPLIED IN THE USSR,
State Hydrological Inst., Leningrad (USSR).
P. P. Kuzmin.
In: Symposium on World Water Balance, Vol 1, International Association of Scientific Hydrology Publication No 92, p 225-231, July 1970. 7 p, 12 ref.

Descriptors: *Water balance, *Evaporation, Heat budget, Hydrologic budget, Winds, Diffusion, Evapotranspiration, Air temperature, Humidity, Data collections, Data processing, Lysimeters, Runoff, Inflow, Soil water, Soil water movement.
Identifiers: USSR.

Climatological and balance methods used for estimation of evaporation from land, snowpack and swamps applied in the USSR are reviewed. Balance methods are based on detailed study of water and heat components. They are accurate enough, but seldom used. Climatological methods proceed from simplified computation schemes based on the plotting of empirical relations and the usage of data of standard meteorological observations from hydrometeorological stations. The method of turbulent diffusion, which is also known as the method of gradient observations, has both a theoretical and an empirical basis. The principle of turbulent diffusion method consists in the recording of the vapor flux directed vertically from the evaporating surface. The basic material for the determination of the coefficient of turbulent exchange and of other parameters of the computation scheme is the measurement data on vertical gradient of wind speed, air temperature and humidity above the evaporating surface. (Knapp-USGS)
W71-02772

THE PREDICTION OF ACTUAL EVAPORATION IN SEMI-ARID AREAS,
Hydrological Research Unit, Wallingford (England).
J. V. Sutcliffe, and C. H. Swan.
In: Symposium on World Water Balance, Vol 1, International Association of Scientific Hydrology Publication No 92, p 213-224, July 1970. 12 p, 5 fig, 3 tab, 7 ref.

Descriptors: *Water balance, *Arid lands, *Rainfall-runoff relationships, *Evapotranspiration, *Vegetation effects, Soil water, Infiltration, Forests, Mapping, Rainfall, Runoff, Hydrologic budget, Precipitation (Atmospheric).
Identifiers: *Iran.

It is essential to consider the role of the soil moisture regime in dividing rainfall between actual evaporation and runoff in arid lands. The dangers of the simple comparison of rainfall and potential evaporation are illustrated by comparing the two sides of the Alborz range in Iran. The southern slopes receive moderate winter precipitation but because of this seasonal distribution the actual evaporation is low compared with the high annual potential evaporation; the runoff is relatively high. The northern slopes facing the Caspian Sea receive summer rainfall as well but the actual evaporation is high and the runoff low. The cause of this apparently anomalous situation is the forest on the Caspian slopes which transpires at the potential rate where the perennial rainfall allows it to survive. A study which took account of the limited soil moisture storage and the seasonal precipitation pattern would predict this result at least in qualitative terms. While global and regional rainfall maps, together with maps of potential evaporation, are an essential first step towards a gter balance, any realistic study must take account of the existing information on regional runoff, soil depths, and vegetation. (Knapp-USGS)
W71-02773

ESTIMATION AND MAPPING OF EVAPORATION,
British Meteorological Office, Bracknell (England).
J. Grindley.
In: Symposium on World Water Balance, Vol 1, International Association of Scientific Hydrology Publication No 92, p 200-213, July 1970. 14 p, 5 fig, 1 tab, 8 ref.

Descriptors: *Evaporation, *Evapotranspiration, Hydrologic budget, Water balance, Meteorology, Soil moisture, Soil water, Mapping, Land use, Networks.
Identifiers: *Potential evaporation, Penman method, United Kingdom, England, Wales.

Most evaporation data in the United Kingdom are obtained using the Penman formula, which permits calculations of potential evaporation. By making assumptions about the way in which actual evaporation falls below the potential as soil moisture becomes limiting, it is possible to calculate and map soil moisture deficit. Careful assessment of land use permits an assessment of actual evaporation and soil moisture deficit over any specific catchment area for use in water balance studies. A provisional map of potential evaporation was prepared for England and Wales and a map of actual evaporation is being prepared using a 10 km network of grid intersections with an appropriate

spectrum of land use for each intersection. (Knapp-USGS)
W71-02774

PRECIPITATION AND EVAPORATION-THEIR PRACTICAL AND OPERATIONAL ASPECTS FOR THE WATER CYCLE BALANCE,
World Meteorological Organization, Geneva (Switzerland). Div. of Hydrometeorology.
For primary bibliographic entry see Field 02B.
W71-02775

EXPERIMENTAL INVESTIGATIONS AND COMPUTATION OF EVAPORATION FROM WATER SURFACE,
State Hydrological Inst., Leningrad (USSR).
V. I. Kuznetsov.
In: Symposium on World Water Balance, Vol 1, International Association of Scientific Hydrology Publication No 92, p 153-160, July 1970. 8 p, 2 fig, 2 tab, 12 ref.

Descriptors: *Evapotranspiration, *Water balance, *Evaporation, Soil moisture, Lakes, Instrumentation, Evaportranspiration control, Hydrologic cycle, Lysimeters, Evaporation pans, Monomolecular films.
Identifiers: USSR.

A brief description is presented of investigations of evaporation from water surface in the USSR. Standard instruments, methods for measurement and computation of evaporation are described. Measurements of evaporation from free water surface on the USSR network stations are performed by means of 20 sq m evaporation tanks, 2 m deep, and evaporimeters (GGI-3000) which are either installed in soil on continental evaporation plots or on special rafts on lakes and reservoirs. The USSR evaporation network comprises approximately 490 observation points, of which 55 are equipped with evaporation tanks and evaporimeters, while the rest have only evaporimeters. This network includes about 30 floating evaporation installations. The influence of vegetation growth in lakes and reservoirs on evaporation, evaporation from turbid, mineralized and polluted water, the reduction of evaporation from water surfaces covered by oil and monomolecular films, and other factors are also studied. (Knapp-USGS)
W71-02779

WATER BALANCE OF SWAMPS AND ITS COMPUTATION,
State Hydrological Inst., Leningrad (USSR).
For primary bibliographic entry see Field 02E.
W71-02785

CATCHMENT EVAPORATION AS MANIFESTED IN CLIMATOLOGIC OBSERVATIONS,
Dept. of Energy, Mines and Resources, Ottawa (Ontario). Hydrologic Sciences Div.
F. I. Morton.
In: Symposium on World Water Balance, Vol 2, International Association of Scientific Hydrology Publication No 93, p 421-433, July 1970. 13 p, 2 fig, 1 tab, 14 ref.

Descriptors: *Evaporation, *River basins, *Model studies, Hydrologic data, Climatic data, Meteorological data, Soil moisture, Vegetation, Precipitation (Atmospheric), Runoff, Equations, Evapotranspiration, Humidity, Air temperature, Solar radiation, International Hydrological Decade.
Identifiers: *Canada, *Ireland.

When evaporation from a large area is limited by the moisture supply, there are changes in heat content and water vapor content of the lower atmosphere. Therefore, potential evaporation, which is effected by temperature and humidity of the bottom layer of air, may be regarded as a manifestation of regional evaporation. This permits the formulation of an equation in which the sum of regional and potential evaporation is equal to the evaporation equivalent of the absorbed global radiation so that regional evaporation, a product of climatic, soil moisture and vegetative processes, may be estimated by its effects on climatologic observations. The resultant model is tested with hydrologic and climatologic data from 20 river catchments in Canada and Ireland, representing a range in annual runoff of approximately zero to one meter and a range of snow cover duration of approximately zero to six months. Comparison of model predictions with precipitation less runoff estimates over five-year periods provides good evidence for the validity of the model and interesting insights into the seasonal variability of catchment storage. (Woodard-USGS)
W71-02793

APPLICATION OF SOME EMPIRICAL METHODS IN THE STUDY OF EVAPOTRANSPIRATION IN IRAN,
Institute of Hydro-Sciences and Water Resources Technology, Tehran (Iran).
M. Mozayeni.
In: Proceedings of Central Treaty Organization Seminar on Evaluation of Water Resources With Scarce Data, March 4-8, 1969, Tehran, Iran, p 181-194, January 1970. 14 p, 7 fig, 3 tab.

Descriptors: *Water resources, *Evapotranspiration, *Streamflow, *River basins, Hydrologic data, Air temperature, Humidity, Precipitation (Atmospheric), Atmospheric pressure, Solar radiation, Equations, Water loss, Methodology, Water balance.
Identifiers: *Iran, *Scarce data, Empirical formulas, Theoretical formulas.

Some quantitative results are described of application of empirical and theoretical methods to estimating evapotranspiration in several regions of different climatic conditions in Iran. The three major climatic zones are Caspian Littoral, Plateau and foothills, and the Southern Coastal plain. Whereas the annual average precipitation in Iran is about 250 mm, the potential evaporation is almost 10 times that amount. Potential evapotranspiration may be estimated by the Penman, Turc or Thornthwaite methods. The Penman method is more appropriate for plains in the Central Plateau having continental climate with high radiation and moderate temperature. The Thornthwaite method is not applicable to the Plateau but is appropriate for the Caspian Sea coastal region. Data are lacking for direct measurements by lysimeters and for solar radiation. An experimental catchment 60 sq km in area is being set up in Iran to determine the water balance and other parameters as part of the International Hydrological Decade. (Lang-USGS)
W71-02819

SPRING EVAPOTRANSPIRATION FROM LOW SAGEBRUSH RANGE IN SOUTHERN IDAHO,
Idaho Univ., Moscow. Water Resources Research Inst.
George H. Belt, Jr.
Available from NTIS as PB-196 349, $3.00 in paper copy, $0.95 in microfiche. Research Project Technical Completion Report, University of Idaho, Water Resources Research Institute, Moscow, Idaho, October 1970. 44 p, 16 fig, 6 tab, 7 ref. OWRR Project A-014-IDA (2).

Descriptors: *Evapotranspiration, Evaporation, *Energy budget, Boundary layers, Latent heat, Idaho, Transpiration, *Sagebrush.
Identifiers: *Evaporative flux rates.

Evapotranspiration was measured from low sagebrush covered range land at the Reynolds Creek Experimental Watershed, Reynolds, Idaho. The objectives of the study were twofold: To measure the magnitude of and variation in evaporative flux rates for low sagebrush range; and To identify those parameters of the microclimate which were significant in causing daily and hourly variation in flux rates. Evapotranspiration (E.T.) from the low sagebrush range (38% crown cover), using the Bowen-ratio technique, indicates typical E.T. rates of 0.025 - 0.40 mm/hr. Losses during daylight hours ranged from 1.27 - 3.0 mm and represented 33 - 46% of the net radiation. Advection of sensible heat was negligible. Soil moisture during the May - June period ranged from 17 - 40% by volume. The instrumentation developed for Bowen - ratio energy balance measurements is also described.
W71-02830

SORGHUM FOLIAR RESPONSES TO CHANGES IN SOIL WATER CONTENT,
Agricultural Research Service, Phoenix, Ariz. Water Conservation Lab.
W. L. Ehrler, and C. H. M. van Bavel.
Agronomy Journal, Vol 59, p 243-246, 1967. 5 fig, 11 ref.

Descriptors: *Sorghum, *Crop response, *Foliar, *Soil moisture, *Moisture content, Moisture stress, Soil-water-plant relationships, Temperature, Evapotranspiration, Transpiration, Arizona, Arid lands, Leaves, Moisture availability, Stomata, Plant physiology, Lysimeters, Resistance, Diurnal, Diffusion, Irrigation effects.
Identifiers: *Transpiration resistance, *Beta-ray gauge technique, Leaf temperature, Leaf thickness.

Plant response to field differences in water availability was measured in grain sorghum in central Arizona during July 1965. Measurements were made during two 24-hour periods of meteorological factors, transpiration resistance, leaf temperature and thickness evaporation in dry soil and, after irrigation, in wet soil. Limited soil water availability counteracted normal, light-induced stomatol opening. This caused increased daytime values of leaf diffusion resistance, decreased evapotranspiration, and caused leaf temperatures that exceeded air temperature. Leaf thickness (measured by a beta-ray gauge) decreased negligibly from the dawn reference value, even when the soil water content approached the 15-bar percentage. The absence of significant leaf response is a failure of the beta-ray gauge technique to measure water content of sorghum leaves. Figures show leaf diffusion resistance (by lysimeters), measured evaporation from dry and wet soil compared to potential evaporation, relative leaf temperature before and after irrigation and leaf thickness during the experiments. (Popkin-Arizona)
W71-02865

THE INFLUENCE OF XYLEM ARRANGEMENT AND TRANSPIRATION ON THE DISTRIBUTION OF SOLUTES IN COTTON,
Texas A and M Univ., College Station. Dept. of Plant Sciences.
R. R. Hoverson, and Joseph Hacskaylo.
Texas A and M University, Texas Agricultural Experiment Station, MP-889, August 1968. 11 p, 8 fig, 3 tab, 2 ref.

Descriptors: *Transpiration, *Transpiration control, *Cotton, *Xylem, *Insecticides, Solutes, Plant physiology, Soil-water-plant relationships, Plant tissues, Leaves, Movement, Spatial distribution.
Identifiers: *Azodrin, Petiole infusion, Acropetal movement, Anastomosis, Lateral wall performations.

Irrigated cotton is an important crop in semiarid and arid lands. Covered cotton leaf experiments indicate that transpiration effect on Azodrin distribution following stem application and petiole infusion is direct. Accumulated insecticide in any plant part is proportional to transpired water from that part. The cotton xylem system dictates the destination of solutes because of its spatial arrangement. When the xylem system has access to the treatment solute, all plant parts may accumulate solute, depending on transpiration amount. When only specific xylem parts are insecticide treated, solute distribution is limited to subsequent acropetal ramifications and interconnections of those

specific xylem elements. This distribution is by way of anastomosis and lateral wall perforations. The specific conduits of insecticide movement are subject to controlling transpiration forces, as the solute moves acropetally. Figures show Azodrin accumulation, leaf properties, and plant sections. Tables show Azodrin distribution in cotton plants. (Popkin-Arizona)
W71-02968

THE ROLE AND MEASUREMENT OF DEW,
Zentralanstalt fuer Meteorologie und Geodynamik, Vienna (Austria).
W. Muller.
Agroclimatological Methods; Proceedings of the Reading Symposium, Natural Resources Research, Vol 7, p 303-307, UNESCO, 1968. 5 tab, 5 ref.

Descriptors: *Evaporation, *Energy budget, *Arid lands, *Dew, *Estimating equations, Thermodynamic behavior, Instrumentation, Measurement, Environmental effects, Climatology, Rime, Microenvironment, Data collections, Mode of action, Microclimatology, Energy transfer, Evaluation, Condensation, Air-earth interfaces, Heat balance, Temperature, Vapor pressure, Water balance, Precipitation (Atmospheric).
Identifiers: *Agroclimatology, *Exchange coefficient, Formulae.

In arid and semiarid regions the role of dew as a term of the energy balance is particularly important. Dew formation is a term connected with negative heat balance of the surface, which allows the construction of a highly general formula. A large number of instruments are available for dew and moisture measurements and methods and instruments are listed. For this reason it is difficult to choose a standard instrument. Starting with the energy balance equation, a universal exchange coefficient is defined and a formula for the calculation of dew amount is derived. When calculated and measured valves were compared for a site in Austria, satisfactory agreement was obtained. Sudden local winds often caused dew evaporation. Only in one extremely dry month did the monthly total of dew reach the magnitude of the rainfall--which reflects the fact that dew is unimportant to the moisture balance except in very dry regions. Its important role lies in its persistence and resulting evaporation suppression. Further investigations are needed on the importance of dew in connection with evaporative processes. (Casey-Arizona)
W71-02974

POTENTIAL EVAPOTRANSPIRATION IN A WARM ARID CLIMATE,
Meteorological Dept., Cairo (Egypt).
M. H. Omar.
Agroclimatological Methods; Proceedings of the Reading Symposium, Natural Resources Research, Vol 7, p 347-353, UNESCO, 1968. 5 tab, 10 ref.

Descriptors: *Arid climates, *Advection, *On-site data collections, *Estimating equations, *Evapotranspiration, Climatology, Environmental effects, Measurement, Instrumentation, Energy budget, Temperature, Solar radiation, Vapor pressure, Wind velocity, Rainfall, Summer, Winter, Monthly, Irrigated land.
Identifiers: *Potential evapotranspiration, *United Arab Republic, *Agroclimatology, *Psychrometers, *Evapotranspirometers, Formulae.

Measurement of potential evaporation in warm arid areas is complicated by advection effects and usually requires a large (1-2 acres) irrigated field. Measurements were made in a small grass field in Cairo (1960-1965) with modified Mather evapotranspirometers and psychrometers (energy balance method) during both summer and winter. Similar measurements were made in a large grass field (Gezira) which had similar climatological conditions. The data from the 2 measuring techniques were compared as well as the data from the 2 fields. Energy budget measurements were consistently less than evapotranspirometer measurements and were explained by the effects of downward moisture advection. Using data from both types of measurement, Gezira/Giza evapotranspiration ratios were determined, showing how monthly evapotranspiration valves in a small field, measured by evapotranspirometers could be corrected for advection effects allowing estimation of average values for large fields. The corrected valves were then compared with calculations according to the Penman, Papadakis, Thornthwaite and Hamon methods. The Papadakis and Penman formulas were very accurate while the others underestimated by about 35 percent. It is felt that the simplicity of the Papadakis formula recommends its use in arid areas if its accuracy is established. (Casey-Arizona)
W71-02975

EVAPOTRANSPIRATION OF A NATURE CITRUS ORCHARD,
Florida Univ., Gainsville. Dept. of Fruit Crops.
J. F. Gerber.
Available from NTIS as PB-190 123, $3.00 in paper copy, $0.95 in microfiche. Final Report, January 1970. 22 p, 4 tab, 4 fig, 4 ref. Weather Bureau Grant WBG-84.
Identifiers: *Trees, *Evapotranspiration, Mathematical analysis, Energy, Water supplies, Temperature, Humidity, Radiation effects, Moisture, Rainfall, Soils, Wind, Irrigation systems, Recording systems, Micrometeorology, Data processing systems, Sampling, Fruits, Moisture balance, *Citrus trees.

The changes in soil moisture as measured with the neutron probe were used to calculate the hydrologic value of evapotranspiration. Since the mean change in soil moisture is dependent upon the volume of moisture exhaustion by the roots of the tree it was assumed that on the basis of the previous study that some adjustment should be made to compensate for a lack of uniformity in moisture usage. Consequently, each tree was assigned an area of 625 square feet since they were spaced 25 by 25. An adjustment for the volume around the trunk, the drip and that which remained in the middle was made. On this basis soil moisture changes were computed by the assignment of individually weighted constants to compensate for the percentage of each unit area that was involved in the area near the trunk beneath the canopy and in the middle. In this manner adjusted moisture use was obtained for a hypothetical column of soil with a unit cross section extending to a depth of 5 ft. Changes in the water content of this hypothetical column were used in the estimation of the hydrologic balance.
W71-03087

MEASURING FOREST EVAPOTRANSPIRATION - THEORY AND PROBLEMS,
Forest Service (USDA), Durham, N.H. Northeastern Forest Experiment Station.
C. Anthony Federer.
Forest Service Research Paper NE-165, 1970. 25 p, 1 fig, 1 tab, 68 ref, append.

Descriptors: *Evapotranspiration, *Forests, *Reviews, Advection, Consumptive use, Energy budget, Evaporation, Meteorology, Transpiration, Analytical techniques.
Identifiers: *Forest evapotranspiration.

Methods of estimating forest evapotranspiration are reviewed. Only the soil-water budget and the micrometeorological methods offer any degree of success. These procedures are described pointing out the limitations of the soil-water sampling method, but noting that the micrometeorological approach provides several related methods that offer the best opportunities for accurately measuring evapotranspiration. Mass transfer, eddy correlation, difference, Bowen ratio, and combinations are discussed. Less expensive and more reliable instruments must be developed before they can be used routinely for hydrologic research. (Knapp-USGS)
W71-03122

SOIL WATER EVAPORATION: FIRST STAGE DRYING AS INFLUENCED BY SURFACE RESIDUE AND EVAPORATION POTENTIAL,
Agricultural Research Service, Mandan, N. Dak. Soil Water Conservation Research Div.
J. J. Bond, and W. O. Willis.
Soil Science Society of America Proceedings, Vol 34, No 6, p 924-928, November-December 1970. 5 p, 7 fig, 1 tab, 13 ref.

Descriptors: *Evaporation, *Soil water, Hydraulic models, Model studies, Lysimeters, Mulching, Evaporation control, Water conservation, Air-earth interfaces.
Identifiers: *Soil water evaporation.

Evaporation rate was measured in wetted columns of fine sandy loam treated with straw as surface residue, at six different evaporation potentials. First stage (constant rate) evaporation rate decreased with either increasing residue depths or decreasing evaporation potentials. Total water loss during first stage drying decreased as the rate of first stage evaporation increased. Conversely, water loss for the first 24 days following first stage drying increased as first stage evaporation rate increased. (Knapp-USGS)
W71-03141

2E. Streamflow and Runoff

USE OF RUNOFF FORECASTING IN RESERVOIR OPERATIONS,
Salt River Project, Phoenix, Ariz.
For primary bibliographic entry see Field 04A.
W71-02758

A METHOD FOR RUNOFF-MAPPING FROM PRECIPITATION AND AIR TEMPERATURE DATA,
For primary bibliographic entry see Field 02A.
W71-02767

SURFACE WATERS AS ELEMENTS OF THE WORLD WATER BALANCE,
Moscow State Univ. (USSR).
For primary bibliographic entry see Field 02A.
W71-02768

CYCLIC VARIATIONS OF RIVER DISCHARGE IN THE NORTHERN HEMISPHERE,
State Hydrological Inst., Leningrad (USSR).
P. S. Kuzin.
In: Symposium on World Water Balance, Vol 1, International Association of Scientific Hydrology Publication No 92, p 160-164, July 1970. 5 p.

Descriptors: *Streamflow, *Synoptic analysis, *Mass curves, Statistical methods, Statistics, Correlation analysis, Rainfall-runoff relationships, Frequency analysis, Mapping, Surveys.
Identifiers: River discharge variation.

Territorial regularities of distribution of cyclic variations, synphases and asynphases of streamflow rivers of the Northern Hemisphere were studied by normalized difference mass curves and correlation methods. The USSR and the territories of other countries of the Northern Hemisphere were classified according to the type of synphases of annual streamflow variations. Asynphases of streamflow and the possibility of compensation of low river discharge in some regions by high river discharge in other regions during the same years are possible. Modulus coefficients of both low and high streamflow phases decrease from north to south. For low flow the frequency increases from north to south, whereas for high flow, frequency decreases from north to south. The Zonal changes (from north to south) of modulus coefficients and of frequency of low and high streamflow phases are gradual. Intrazonal changes (from west to east) are uneven. Cyclic streamflow fluctuations of big rivers situated in the same geographical zone coincide with the fluctuations of streamflow of the adjacent middle-size rivers. (Knapp-USGS)

W71-02778

FORECASTING OF DRY WEATHER STREAM FLOW,
Baghdad Univ., (Iraq). Coll. of Engineering.
Adnan M. Alsaffar.
In: Symposium on World Water Balance, Vol 1, International Association of Scientific Hydrology Publication No 92, p 122-129, July 1970. 8 p, 4 fig, 11 ref.

Descriptors: *Streamflow forecasting, *Hydrograph analysis, *Low flow, *Surface-groundwater relationships, Water storage, Bank storage, Discharge (Water), Recession curves.
Identifiers: Iraq.

Dry weather stream flow may be forecast by study of depletion of bank storage and basin storage discharges. The analysis is based on the method of hydrograph separation. Equations are derived for the forecasting of these discharges using the runoff hydrograph and the rainfall over the basin. Examination of the derived equations on a stream in Iraq showed the adequacy of this method. (Knapp-USGS)
W71-02780

WATER BALANCE OF SWAMPS AND ITS COMPUTATION,
State Hydrological Inst., Leningrad (USSR).
L. G. Bavina.
In: Symposium on World Water Balance, Vol 2, International Association of Scientific Hydrology Publication No 93, p 461-466, July 1970. 6 p, 1 tab, 8 ref.

Descriptors: *Water balance, *Swamps, Mathematical studies, Equations, Hydrologic cycle, Hydrologic budget, Meteorology, Climatology, Precipitation (Atmospheric), Runoff, Vegetation, Soil moisture, Evapotranspiration, Solar radiation, Evaporation, Topography, International Hydrological Decade, Foreign projects.
Identifiers: *USSR.

A method for computation of runoff from swamps developed on the basis of physical study of water motion in swamps and method for computation of evaporation from swamps depending on the rate of energy advection are presented in a study of water balance of swamps. Computation showed that the difference between long-term average annual values of water balance components of swamps in the zone of excessive moistening and water balance components of the whole river basins is not great. The difference lies within the limits of computation accuracy, which is about 10-12% of the computed values. (Woodard-USGS)
W71-02785

STUDY OF WATER BALANCE ELEMENTS OF FOREST AND FIELD WATERSHEDS,
State Hydrological Inst., Leningrad (USSR).
For primary bibliographic entry see Field 02A.
W71-02786

THE REGULARITIES OF LONG-TERM FLUCTUATIONS OF STREAMFLOW AS A COMPONENT OF THE WATER BALANCE,
For primary bibliographic entry see Field 02A.
W71-02796

SURFACE WATER EVALUATION WITH LIMITED DATA IN THE ARID REGION OF WEST PAKISTAN,
Pakistan Planning Commission, Rawalpindi. Water and Power Div.
Sarfraz Khan Malik.
In: Proceedings of Central Treaty Organization Seminar on Evaluation of Water Resources With Scarce Data, March 4-8, 1969, Tehran, Iran, p 471-487, January 1970. 17 p, 4 fig, 6 ref.

Descriptors: *Water resources, *Surface waters, *Evaluation, *Arid lands, Precipitation (Atmospheric), Runoff, Streams, Stream gages, Sediment load, Equations.
Identifiers: *West Pakistan, *Scarce data.

The total annual flow of the coastal and desert streams in the 134,700 square miles of the arid region of West Pakistan averages between 4 and 5 million acre feet. For evaluation of surface water resources in this arid region, a number of rain gages, and some automatic rain recorders have been set up to measure precipitation and rainfall intensities. Stream gaging stations have also been set up covering the important streams of the area for observing and maintaining river stage and discharge records. Some USGS type Class A Evaporation Pans have also been erected to measure lake evaporation in some areas. Principles and procedures of the evaluation are discussed in the analysis of precipitation data and stream gagings, stage-discharge relations of the streams, the formulation of rainfall-runoff relations, and estimation of the sediment loads of the streams which give an indication of the soil loss taking place from the water-borne river catchments. Topography in the region varies from denuded rocky mountains to some ranges covered with juniper forests. Elevations range from the Arabian Sea coast to about 8000 ft. Shifting controls make stream gaging complex. Large soil losses occur in some basins, ranging from 10,000 to 17,000 tons per sq mi in the Lehri, Chhattar, and others. (Woodard-USGS)
W71-02800

MAXIMUM ONE DAY FALLS OF PRECIPITATION IN TEHRAN,
United Nations Development Program, Tehran (Iran).
For primary bibliographic entry see Field 02B.
W71-02801

WATER INFLOW COMPUTATION OF THE PLANNED ANKARA CERKESHOYUK RESERVOIR,
Topraksu Central Research Inst., Ankara (Turkey).
For primary bibliographic entry see Field 04A.
W71-02804

A NOTE CONCERNING THE IMPROVEMENT OF THE MEAN ANNUAL RUNOFF MAP OF TURKEY,
For primary bibliographic entry see Field 07C.
W71-02805

FREQUENCY ANALYSIS OF RIVER STAGE DATA IN EAST PAKISTAN,
East Pakistan Water and Power Development Authority, Dacca.
Aolad Hosain.
In: Proceedings of Central Treaty Organization Seminar on Evaluation of Water Resources With Scarce Data, March 4-8, 1969, Tehran, Iran, p 383-394, January 1970. 12 p, 4 fig, 4 tab, 6 ref.

Descriptors: *Water resources, *Streamflow, *Frequency analysis, *Hydrologic data, *Foreign projects, River basins, Hydrographs, Discharge measurements, Gaging stations, Peak discharge, Low flow, Surface waters.
Identifiers: *East Pakistan, *River-stage data, Probability curve, Scarce data.

As a basic step in preparing the master plan for water resources development of East Pakistan, probability treatment was given to river stage data from 74 gaging stations on 39 rivers. The length of record of these stations varied from 4 to 54 years, the majority of which had about 15 years of record. Even after extending some of the short records by correlating with long record stations on the same river, it was often necessary to predict an event having a return period of 100 years on stations for which slightly less than 15 years of observed data are available. Because the flood stages of the major rivers of East Pakistan do not vary a great deal, stations with relatively short periods of records can safely be used to determine the stages of floods of rather long return intervals. Tabulations show that by any one frequency analysis technique the difference in 100-year flood stage with 58 years of data and 15 years of data is less than one foot. Actual difference is only 0.12 foot as shown by the mathematically fitted curve. It can also be seen in the tabulation that the simpler frequency analysis techniques give very nearly the same results as the more complex ones. (Woodard-USGS)
W71-02807

ANNUAL WATER LOSSES IN THE CEYHAN BASIN, TURKEY,
For primary bibliographic entry see Field 02A.
W71-02813

REVISION OF THE GAGING STATIONS IN UPPER CEYHAN BASIN, TURKEY,
Electric Power Investigations, Ankara (Turkey). Hydrometric Section.
Mete Turksoy.
In: Proceedings of Central Treaty Organization Seminar on Evaluation of Water Resources With Scarce Data, March 4-8, 1969, Tehran, Iran, p 257-259, January 1970. 3 p, 2 fig, 2 tab, 3 ref.

Descriptors: *Streamflow, *Gaging stations, *Planning, *Runoff, *Foreign projects, Flow characteristics, Flow rates, Peak discharge, Low flow, Surface waters.
Identifiers: *Turkey, *Site selection (Gaging stations).

There are 13 streamflow gaging stations in the Upper Ceyhan Basin, Turkey which are in operation at present. Correlations between mean maximum and minimum discharges are made to determine stations that can be discontinued and stations that can be operated only for maximum and minimum discharges. Meanwhile certain sites are located for new stations. Station and river names, data correlation coefficients, standard error percentages, and results of data correlations are presented in tables and maps. (Woodard-USGS)
W71-02814

ZONES AS TO ANNUAL STREAMFLOW VARIATION IN TURKEY,
Electric Power Investigations, Ankara (Turkey). Hydrometric Section.
Cihangir Kalkan.
In: Proceedings of Central Treaty Organization Seminar on Evaluation of Water Resources With Scarce Data, March 4-8, 1969, Tehran, Iran, p 247-255, January 1970. 9 p, 10 fig, 1 tab, 3 ref.

Descriptors: *Water resources, *Rivers, *Streams, *Foreign projects, Runoff, Streamflow, Gaging stations, Hydrographs, Average, Annual, Discharge (Water), Network design.
Identifiers: *Turkey, Regimen curves, Discharge zones.

Regimen curves of annual average stream discharges for 48 sites in Turkey for the period 1953-66 are presented. The 9 discharge zones into which Turkey is divided, and the station locations are shown on a map. The report is intended as an aid in appraising the general hydrological characteristics of the country and in planning alterations in the streamflow gaging network design. (Woodard-USGS)
W71-02815

THE ESTIMATION OF FACTORS CONTROLLING STREAMFLOW IN AREAS WITH LIMITED DATA,
Institute of Hydrology, Wallingford (England).
J. S. G. McCulloch.
In: Proceedings of Central Treaty Organization Seminar on Evaluation of Water Resources With

Scarce Data, March 4-8, 1969, Tehran, Iran, p 171-180, January 1970. 10 p, 2 tab, 14 ref.

Descriptors: *Water resources, *Streamflow, *Control, *Streamflow forecasting, Hydrologic data, Equations, Precipitation (Atmospheric), Evaporation, Transpiration, Air temperature, Humidity, Foreign projects, River basins, Soil moisture.
Identifiers: *Scarce data, Catchment area research, Control factors.

The streamflow at a given point in a given drainage area depends primarily on the total precipitation falling within the area and on the soil moisture status of the catchment. Where data are scarce, soil moisture must be derived indirectly either by use of an estimate of antecedent precipitation or by estimation of evaporation to enable computation of a water balance. This report relates some of the methods and factors involved with these computations. In areas of scarce data, topography and vegetation are used to estimate precipitation. In Western Iran, for example, it was established that there exists a fairly uniform precipitation/altitude gradient of 300 mm/1,000 m and that when rainfall values are corrected to a standard altitude of 1,000 m the worst of the scatter is removed from the data and an isohyetal map can be drawn. Average precipitation for a given catchment is then derived by interpolation or by planimetering using this constant altitude isohyetal map and adjustment to the mean of the watershed. (Woodard-USGS)
W71-02818

DROUGHT FREQUENCY ANALYSIS BY MEANS OF SYNTHETIC FLOW SEQUENCES,
State Hydraulic Works, Ankara (Turkey). Hydrology Section.
Samin Oztek.
In: Proceedings of Central Treaty Organization Seminar on Evaluation of Water Resources With Scarce Data, March 4-8, 1969, Tehran, Iran, p 155-166, January 1970. 12 p, 6 fig, 2 tab, 6 ref.

Descriptors: *Water resources, *Droughts, *River basins, *Synthetic hydrology, *Streamflow, Foreign projects, Model studies, Equations, Streamflow forecasting, Hydrologic data, Discharge measurements, Mass curves.
Identifiers: *Euphrates Basin, *Keban (Turkey), *Scarce data, Synthetic-flow sequences, Drought frequency.

Hydrologic drought is defined as the deficit of water below a given reference value. In the stochastic model of Euphrates Basin hydrology at Keban, Turkey, it was assumed that the population of monthly flows was statistically normal. The data generation method was used on the normally distributed variables and 6,000 monthly flows generated. For selected reference values magnitude and duration of deficits have been computed. Then, joint distribution of magnitude and duration of deficits was determined. Reservoir capacity necessary to meet particular draft rates during critical droughts having various recurrence intervals is determined. The mass curve analysis based on the 500 yr synthetic records made it possible to determine the capacity necessary to meet a particular draft rate for various droughts having recurrence intervals ranging from 2 yr to 500 yr. (Woodard-USGS)
W71-02821

THE DROUGHTS OF ANTIGUA,
Halcrow (William) and Partners, London (England).
N. J. Cochrane.
In: Proceedings of Central Treaty Organization Seminar on Evaluation of Water Resources With Scarce Data, March 4-8, 1969, Tehran, Iran, p 117-128, January 1970. 12 p, 3 fig, 3 tab, 5 ref.

Descriptors: *Droughts, *Water resources, *Rainfall, Tropical regions, Islands, Equations, Rainfall disposition, Storms.
Identifiers: *Antigua Island (Caribbean).

Antigua, a tropical island in the Caribbean, has a tropical oceanic climate and an average annual rainfall of about 45 inches. There are considerable variations in the annual amounts of rainfall, and recurrent and persistent droughts are a serious problem for the inhabitants. The sugar industry has collapsed under the joint burdens of low prices and drought but its place has been taken, on a grand scale, by tourism. Unfortunately, although the tourist desires clear skies and an absence of rain, he also requires fresh water in abundance so the island's difficulty has not been resolved but is merely oriented differently. Average annual rainfall, rainstorm indices, standard deviation, and frequency diagrams are correlated in evaluating the water resources of the Island. (Woodard-USGS)
W71-02822

WATER UTILIZATION ASPECTS OF WEATHER MODIFICATION AS APPLIED TO KANSAS,
Kansas Water Resources Research Inst., Manhattan.
For primary bibliographic entry see Field 03B.
W71-02827

SIGNIFICANCE OF CAMILLE (1969),
Florida State Univ., Tallahassee. Dept. of Geology.
For primary bibliographic entry see Field 02B.
W71-02908

PREPARATION OF LONG TERM FLOW SEQUENCE FROM SHORT TERM RECORD BY STATISTICAL MEANS,
Ministry of Water and Power, Tehran (Iran).
Davoud Hariri.
In: Proceedings of Central Treaty Organization Seminar on Evaluation of Water Resources With Scarce Data, March 4-8, 1969, Tehran, Iran, p 139-154, January 1970. 16 p, 2 fig, 2 tab.

Descriptors: *Water resources, *Droughts, *Hydrologic data, *Streamflow, Synthetic hydrology, Methodology, Streamflow forecasting, Statistics, Computers, Foreign projects, Watershed management, River basins.
Identifiers: *Marun River (Iran), *Karun River (Iran), *Scarce data, Drought frequency, Synthetic-flow sequence method, Flow duration probability.

This paper describes two methods for carrying out drought frequency analysis for the Marun River basin in Khuzistan, Iran. In the first method a synthetic sequence of hypothetical flows was generated using an electronic computer; flow sequence is derived from the 13 years of historic record. In the second method a long record was drawn up by standard correlation procedures with the nearby Karun River. A very restricted range of flow variation is indicated in the first method compared with the second. The existing record, however, indicates that results of the second method are to be preferred and that the variability characteristics of the river basin are better preserved in the extended record obtained by correlation than in the flow sequence generated synthetically. The use of elaborate techniques requiring sophisticated equipment and computer programs is not necessarily to be preferred to standard methods as shown by a comparison of results of this study. Careful examination of the available data can indicate where the computer and synthetic methods require checking against standard methods. (Lang-USGS)
W71-02920

SURFACE WATER SUPPLY OF THE UNITED STATES, 1961-65: PART 9. COLORADO RIVER BASIN - VOLUME 2.
Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 07C.
W71-02924

EVALUATION OF THE STREAMFLOW-DATA PROGRAM IN OREGON,
Geological Survey, Portland, Oreg.
For primary bibliographic entry see Field 07A.
W71-02925

A PROPOSED STREAMFLOW DATA PROGRAM FOR WISCONSIN,
Geological Survey, Madison, Wis.
For primary bibliographic entry see Field 07A.
W71-02926

MISCELLANEOUS STREAMFLOW MEASUREMENTS IN IDAHO, 1894-1967,
Geological Survey, Boise, Idaho.
For primary bibliographic entry see Field 07C.
W71-02927

DETERMINATION OF PROBABILITY DISTRIBUTION OF MAXIMUM DISCHARGES ON THE BASINS OF ALL OBSERVED FLOODS,
Technical Univ. of Warsaw (Poland).
W. Strupczewski.
In: Floods and Their Computation, Vol 1, International Association of Scientific Hydrology Publication No 84 (Unesco-WMO), p 41-51, 1969. 11 p, 3 fig, 8 ref.

Descriptors: *Flood forecasting, *Statistical methods, *Probability, Rainfall, Snowmelt, Rainfall-runoff relationships, Correlation analysis, Peak discharge, Storm runoff.
Identifiers: Poland.

Floods from rainwater and meltwater may appear in Poland several times within one year, while in other years no distinct floods occur. By adopting the hypothesis of mutual independence of these events, it becomes possible in computation of the annual probability of maximum seasonal discharges to take into account all suitably defined floods. The type of probability distribution used for all floods is completely defined by the hypothetical type of the probability distribution of annual maximum discharges and a given transformation equation. The probability distribution of the maximum annual discharges is obtained from the seasonal discharges by determining the alternate probability of the independent events. The hypothesis of the mutual independence of the maximum discharges from rainfall and from meltwater was verified in numerous gage records from Polish rivers. The basic factor conditioning the applicability of the method of 'all floods' is the evaluation of the accuracy of estimation of probable maximum discharges obtained in this way, in comparison with the values obtained by the traditional method. This problem was solved with the aid of the assumption that both the sets of annual maximum discharges and those of the flood waves are subject to the Fisher-Tippett (type I) distribution. (Knapp-USGS)
W71-02929

IMPROVED PRECISION OF FUTURE HIGH FLOODS,
Central Water and Power Research Station, Poona (India).
G. M. Panchang.
In: Floods and Their Computation, Vol 1, International Association of Scientific Hydrology Publication No 84 (Unesco-WMO), p 51-59, 1969. 9 p, 2 tab, 6 ref.

Descriptors: *Flood forecasting, *Statistical methods, *Reviews, *Probability, Analytical techniques, Peak discharge, Streamflow forecasting.
Identifiers: Flood forecasting techniques.

Methods of predicting maximum streamflows for the design of waterway structures are critically reviewed. Gumbel (1941) postulated initially the use of the Extreme Value Distribution law for evaluating the design floods for the construction of structures across waterways. But the method of moments proposed for estimating its two parameters from the available short term data of annual peak flow were not thought sufficiently precise.

Kimball (1946) discussed the application of the method of Maximum Likelihood for the purpose, but concluded (1956) that one of the resulting normal equations was as intractable of solution. Panchang and Aggarwal (1962) proceeded further and reduced all the routine computational steps to a schematized format for evaluating the parameters successfully and thereby for producing the requisite longterm peak estimates more precisely. The reasons leading to better consistency of such estimates are discussed. (Knapp-USGS)
W71-02930

PRINCIPLES FOR ELABORATION OF MATHEMATICAL RUNOFF MODELS,
Moscow State Univ., Moscow (USSR).
G. P. Kalinin, L. S. Kuchment, and V. I. Koren.
In: Floods and Their Computation, Vol 1, International Association of Scientific Hydrology Publication No 84 (Unesco-WMO), p 60-65, 1969. 6 p, 10 ref.

Descriptors: *Runoff forecasting, *Streamflow forecasting, *Mathematical models, Mathematical studies, Reviews, Rainfall-runoff relationships, Water balance, Hydrologic budget.
Identifiers: USSR, Runoff models.

Two approaches to developing mathematical models of runoff formation are discussed: (1) A basin is considered to be a system whose parameters are unknown and can be determined by means of input and output characteristics; (2) It is assumed that the physical parameters determining runoff formation can be measured directly. On the basis of this assumption a system of differential equations which includes these parameters as partial derivatives is composed. The second method of approach makes it possible to describe the physical processes occurring in the basin in more detail, however its application is rather limited because of great space variation of the physical parameters. Methods of solving inverse problems developed in recent years make it possible to use this method of approach more widely and to bring together both tendencies in developing mathematical models. (Knapp-USGS)
W71-02931

A NUMERICAL MODEL OF THE RUNOFF PROCESS OF MOUNTAIN RIVERS,
U. M. Denisov.
In: Floods and Their Computation, Vol 1, International Association of Scientific Hydrology Publication No 84 (Unesco-WMO), p 65-71, 1969. 7 p, 3 fig.

Descriptors: *Flood forecasting, *Mathematical models, Runoff forecasting, Streamflow forecasting, Systems analysis, Hydrograph analysis, Mathematical studies, Correlation analysis, Discharge (Water), Numerical analysis.
Identifiers: Runoff models.

A mountain river basin is considered as a dynamic system transforming the function of water income to the surface of the basin into a runoff function at the outlet. The design model of snowmelt and rain water income onto the surface of a basin needs data on daily mean air temperature, daily mean humidity and daily amount of precipitation at several (2-5) meteorological stations placed in the basin or near it. Evaporation is assumed to be proportional to saturation deficit and total volume of liquid water content in the basin. The transforming operator of the dynamic system is found on the hypothesis that there is a monotonic rise of correlation curve between discharge at the outlet section and volume of liquid water content in the basin. The method of moments gives a possibility of obtaining a system of equations defining optimum values of transforming operator parameters. The relative error of the discharge hydrograph thus calculated is determined and the parameters' stability is evaluated. (Knapp-USGS)
W71-02932

AN ESTIMATE OF DISCHARGE PROBABILITIES,
Research Inst. for Water Resources Development, Budapest (Hungary).
J. Csoma.
In: Floods and Their Computation, Vol 1, International Association of Scientific Hydrology Publication No 84 (Unesco-WMO), p 72-83, 1969. 12 p, 4 fig, 3 tab, 11 ref.

Descriptors: *Streamflow forecasting, *Discharge (Water), *Mathematical models, *Probability, *Statistical models, Mathematical studies, Statistics, Rainfall-runoff relationships.
Identifiers: Runoff models.

Statistical methods for determining the distribution of the numerical random variables characterizing flood discharges are reviewed. The analysis of the most wide-spread methods showed that the calculated distribution functions in many instances do not satisfy the physical conditions of the phenomenon or meet the requirements of exact mathematical statistics. Generally it can be stated that every monotonic increasing and continuous function can be applied as a distribution function for determining discharges of different probability, wherein at the zero value of the independent variable the dependent variable equals zero, and at the infinite value of the independent variable the dependent variable assumes the value of unity. This definition, however, is not yet in harmony with the physical character of the phenomenon. Among the annual maximum discharges of every permanent watercourse there must be one, below which discharges of smaller value present themselves all with zero probability. The system of equations describing the distribution function is therefore modified so that there is a discharge below which discharges of smaller value have zero probability. (Knapp-USGS)
W71-02933

THE ESTIMATION OF EXTREME PRECIPITATION AS THE BASIS FOR DESIGN FLOODS - RESUME OF PRACTICE IN THE UNITED STATES,
Weather Bureau, Silver Spring, Md. Office of Hydrology.
Vance A. Myers.
In: Floods and Their Computation, Vol 1, International Association of Scientific Hydrology Publication No 84 (Unesco-WMO), p 84-104, 1969. 21 p, 6 fig, 54 ref.

Descriptors: *Design flood, *Design storm, *Flood forecasting, *Spillways, Probable maximum precipitation, Reviews, Maximum probable flood, Bibliographies, Routing, Hydrology, Water management (Applied), Flood protection, Flood control, Reservoir design, Reservoir operation.
Identifiers: Flood control project design, Spillway design.

The spillways of most large dams built in the United States in the last 25 years are designed to carry the flood resulting from probable maximum precipitation. The historical reasons for this particular approach to design in the United States are reviewed, the procedures that have evolved for estimating probable maximum precipitation are summarized, and design trends are discussed. (Knapp-USGS)
W71-02934

DESIGN RAINFALL CHARACTERISTICS OF THE USSR TERRITORY,
State Hydrological Inst., Leningrad (USSR).
E. A. Smirnova.
In: Floods and Their Computation, Vol 1, International Association of Scientific Hydrology Publication No 84 (Unesco-WMO), p 105-114, 1969. 10 p, 2 fig, 3 tab, 3 ref.

Descriptors: *Design storm, *Hydrograph analysis, *Rainfall-runoff relationships, Rainfall intensity, Rainfall disposition, Statistical methods, Hyetographs, Duration curves.
Identifiers: USSR.

A method of processing hyetographs to obtain design rainfall characteristics used in maximum storm runoff computation is summarized. The technique provides, for a homogeneous climatic region: (1) The plotting of a curve of maximum depth increase with time interval increase and (2) The plotting of a curve of mean rainfall intensity decrease with time interval increase for certain exceedence or frequency probabilities. Depth of rainfall intensity for a required time interval can be determined for any point with known daily rainfall; Ordinates of reduction curves are only slightly dependent on frequency and change slowly. Curves of rainfall reduction have been plotted for different physiographical regions of the USSR and characteristics of the main types of reduction curves and their territorial distribution are given. (Knapp-USGS)
W71-02935

OBJECTIVE STATISTICAL METHODS OF COMPUTATION AND GENERALIZATION OF THE PARAMETERS OF MAXIMUM RAINFALL RUNOFF,
State Hydrological Inst., Leningrad (USSR).
For primary bibliographic entry see Field 02A.
W71-02936

APPLICATION OF THE METHOD OF MAXIMUM RUNOFF COMPUTATION USING THE PRECIPITATION REDUCTION CURVES IN THE MARITSA RIVER BASIN,
Bulgarian Academy of Sciences, Sofia. Inst. of Hydrology and Meteorology.
S. G. Georgiev.
In: Floods and Their Computation, Vol 1, International Association of Scientific Hydrology Publication No 84 (Unesco-WMO), p 128-135, 1969. 8 p, 3 fig, 1 tab.

Descriptors: *Flood forecasting, *Floods, *Statistical methods, *Estimating, *High water mark, *Surveys, Frequency analysis, Probability, Rainfall-runoff relationships, Water balance.
Identifiers: Bulgaria.

A method is described for computing rainfall-runoff relationships for river basins by plotting frequency curves based on maximum precipitation data used with stage data obtained from a flood-height survey by questionnaire. The method was developed to compute maximum runoff in the Maritsa Basin, Bulgaria, a basin without adequate gaging stations for standard flood-runoff computations. (Knapp-USGS)
W71-02937

ON THE EXPEDIENCY OF USING COMBINED SERIES OF HYDROLOGICAL CHARACTERISTICS FOR FLOOD COMPUTATION,
State Hydrological Inst., Leningrad (USSR).
A. I. Chebotarev, and B. I. Serpik.
In: Floods and Their Computation, Vol 1, International Association of Scientific Hydrology Publication No 84 (Unesco-WMO), p 135-144, 1969. 10 p, 4 fig.

Descriptors: *Flood forecasting, *Statistical methods, Probability, Frequency analysis, Estimating, Rainfall-runoff relationships, Regression analysis.
Identifiers: *USSR.

Parameters of runoff frequency curves derived from small samples with great variability result in considerable errors of runoff computation. The adjustment of frequency curve parameters to long-term observation periods and the analysis of information concerning streamflow and hydrometeorological characteristics in homogeneous physiographic regions are usually performed with the aim of decreasing this error. To overcome the difficulties encountered in calculations, hydrological series are combined in a population within homogeneous regions. This population is considered as a stable general one, which can be used for distribution characteristics at any point

(discharge site) in a given region. The condition when ordinates of individual frequency curves are within conventionally selected limits is sometimes taken for the series homogeneity criterion; these limits are assumed to be the difference between the ordinates of 3% and 97% frequency from the general population. The combined series criterion does not provide a homogeneous population. Moreover the existing correlation relationship between runoff of adjacent streams causes a greater instability in time of the generalized curve depending on the rate of streamflow of the period for which the series is produced. The conditions result in a considerable decrease in the calculation accuracy on available long-term series and in complete indeterminacy of calculation for discharge sites with short-term periods of observation. (Knapp-USGS)
W71-02938

ESTIMATING THE ACCURACY OF STATISTICAL FLOOD VALUES BY MEANS OF LONG-TERM DISCHARGE RECORDS AND HISTORICAL DATA,
E. Glos, and R. Krause.
In: Floods and Their Computation, Vol 1, International Association of Scientific Hydrology Publication No 84 (Unesco-WMO), p 144-151, 1969. 8 p, 3 fig, 2 tab, 9 ref.

Descriptors: *Flood forecasting, *Statistical methods, *Probability, Estimating, Sampling, Surveys, Frequency analysis, Gaging stations, Data collections.
Identifiers: Flood data analysis.

Short-term records are frequently used for estimating peak flows at different recurrence intervals. To determine the accuracy of these estimates empirical frequency curves are established from long-term records and additional historical information. The long-term records are divided into parts of various length to estimate the relationship between accuracy and length of record. The results are valid for a limited range of coefficient of variation from 0.4 to 0.7. (Knapp-USGS)
W71-02939

ASSESSMENT OF A DESIGN DISCHARGE OF A RIVER,
J. W. Van der Made.
In: Floods and Their Computation, Vol 1, International Association of Scientific Hydrology Publication No 84 (Unesco-WMO), p 152-164, 1969. 13 p, 8 fig, 2 tab, 1 ref.

Descriptors: *Flood forecasting, *Statistical methods, *Frequency analysis, *Design flood, Design flow, Streamflow, Hydrographs, Maximum probable flood, Project planning.
Identifiers: Flood frequency.

The concept 'maximum discharge that will ever occur' is incorrect; there is no cause for a fixed discharge ceiling. However, it is possible to assess a design discharge based on the acceptable risk. It can be derived from the frequency curve of the peak discharges of flood waves. If the period of observation from which the frequency curve is derived is much shorter than the proposed lifetime of the project is is necessary to extrapolate the frequency curve. It is illogical to expect the discharges, caused by complicated hydrological and geographical conditions, to follow a simple mathematical scheme. A graphical presentation is preferable; a linear scale of discharges and a logarithmic scale of frequencies are suitable. A method for the extrapolation of the frequency curve is discussed. (Knapp-USGS)
W71-02940

ESTIMATION OF FLOOD FLOWS USING MATHEMATICAL STATISTICS,
Energoprojekt, Belgrade (Yugoslavia).
M. Melentijevich.
In: Floods and Their Computation, Vol 1, International Association of Scientific Hydrology Publication No 84 (Unesco-WMO), p 164-174, 1969. 11 p, 4 fig, 2 tab, 7 ref.

Descriptors: *Flood forecasting, *Statistical methods, *Probability, Frequency analysis, Streamflow, Analytical techniques, Hydrograph analysis, Peak discharge.
Identifiers: Danube River, Drina River.

The estimation of frequency of floods is considered from the viewpoint of mathematical statistics. This requires, essentially, the estimation of the tail of a probability distribution curve from a sample of values which usually does not include values in this tail. The error in the estimation of floods corresponding to a given probability arises from the uncertainty as to the mathematical form of the distribution and the uncertainty arising from the statistical errors of estimation of the parameters of the distribution, which occur because of the finiteness of the length of record. These errors are illustrated on a numerical example by fitting a log-normal distribution to annual values of extreme flow of the Danube and Drina Rivers for different lengths of records. (Knapp-USGS)
W71-02941

SPATIAL AND TEMPORAL ANALYSIS OF MAXIMUM RUN-OFF,
Moscow State Univ., Moscow (USSR).
G. P. Kalinin, and N. V. Nikolskaya.
In: Floods and Their Computation, Vol 1, International Association of Scientific Hydrology Publication No 84 (Unesco-WMO), p 174-183, 1969. 10 p, 3 fig, 2 tab, 7 ref.

Descriptors: *Runoff forecasting, *Streamflow forecasting, *Statistical methods, Data collections, Hydrologic data, Regression analysis, Frequency analysis, Probability, Discharge (Water).
Identifiers: *USSR.

Runoff observation data of the Northern hemisphere are summarized. In a large territory for a given period of time regions can be distinguished where runoff rate is extremely low and where runoff rate is extremely high. In the Northern hemisphere some regions have predominantly synchronous runoff (positive correlation) and some regions have predominantly asynchronous runoff (negative correlation). For a large territory the influence of reciprocal correlation on the shape of runoff distribution curves is balanced reciprocally. Under these conditions the use of observations in time and space permits generalized frequency curves of runoff which take into account a theoretical probability scheme of runoff formation. The shape of the theoretical frequency curves of runoff depends essentially on the period of averaging; the longer the period the less is the asymmetry. Generalization of frequency curves of runoff substantiates the choice of design values of flood runoff. (Knapp-USGS)
W71-02942

ON A GENERAL THEORY OF DURATION CURVE AND ITS APPLICATION TO EVALUATE THE PLOTTING POSITION OF MAXIMUM PROBABLE PRECIPITATION OR DISCHARGE,
India Meteorological Dept., New Delhi.
S. Banerji, and D. K. Gupta.
In: Floods and Their Computation, Vol 1, International Association of Scientific Hydrology Publication No 84 (Unesco-WMO), p 183-193, 1969. 11 p, 6 fig, 3 tab, 2 ref.

Descriptors: *Streamflow forecasting, *Duration curves, *Probability, *Mathematical studies, Statistical methods, Hydrographs, Design flood, Design flow, Probable maximum precipitation.
Identifiers: *India.

A generalized theory of duration curve for known length of record and sample size is given. The plotting position of each of the sample values used in the construction of the curve can be readily calculated to a high degree of accuracy without using the method of successive approximations from a polynomial of degree equal to the size of the sample. The theory has a special utility in the evaluation of plotting positions of certain values not present in the sample, for use in design purposes. The technique has been applied for obtaining the maximum probable precipitation and the maximum probable flood of a desired return period with a specified probability of non-exceedence. (Knapp-USGS)
W71-02943

ON THE METHOD OF UNIT HYDROGRAPH AND MODELLING OF RAINFALL FLOODS BY ELECTRONIC ANALOGUE COMPUTERS,
State Hydrological Inst., Leningrad (USSR).
For primary bibliographic entry see Field 02A.
W71-02944

COMPUTATION PRINCIPLES OF FLOOD HYDROGRAPHS,
State Hydrological Inst., Leningrad (USSR).
For primary bibliographic entry see Field 02A.
W71-02945

DETERMINATION OF MAXIMUM FLOW FROM HIGHWATER MARKS. (FRENCH),
Grenoble Univ. (France).
M. Parde.
In: Floods and Their Computation, Vol 1, International Association of Scientific Hydrology Publication No 84 (Unesco-WMO), p 230-238, 1969. 9 p.

Descriptors: *Floods, *High water mark, *Flood forecasting, *Historic flood, Peak discharge, Roughness (Hydraulic), Channel morphology, Stage-discharge relations, Probability.
Identifiers: Probable maximum flood.

Extreme historical floods can be of great service, when through their interpretation it can be presumed with reasonable certainty that discharges higher than the highest recent discharges took place in the past. This is also confirmed by indications derived from the computation of probabilities. The available highwater marks must not be displaced vertically since recent floods. There must be a reliable relation between the height of the bench-mark and that of a neighbouring gage with a known stage-discharge relationship. Stages may differ considerably at different banks and at places upstream and downstream from bridges. It is also necessary to know whether the cross-sections, the slope and the channel roughness of the river are natural or artificial. (Knapp-USGS)
W71-02946

INCREASING THE ACCURACY OF DETERMINATION OF MAXIMUM DISCHARGES AND THEIR EXCEEDENCE PROBABILITY,
E. V. Boldakov.
In: Floods and Their Computation, Vol 1, International Association of Scientific Hydrology Publication No 84 (Unesco-WMO), p 238-245, 1969. 8 p, 3 fig, 2 tab, 2 ref.

Descriptors: *Streamflow forecasting, *Reservoir design, *Discharge (Water), Water balance, Hydrologic budget, Rainfall-runoff relationships, Reservoir construction, Planning, Water management (Applied).
Identifiers: Reservoir planning.

Improved distribution curves may be used to determine maximum discharges on large and medium rivers. Methods are given to determine maximum discharges for small watersheds by means of solution of the water balance equation. This solution enables account to be taken of water storage in the upper pool of a reservoir. An annual decrease in reinforced concrete consumption of 25% is possible while satisfying storage requirements. (Knapp-USGS)

W71-02947

EXTRAPOLATION OF DISCHARGE RATING CURVES USING CHEZY'S FORMULA,
State Hydrological Inst., Leningrad (USSR).
R. A. Shestakova.
In: Floods and Their Computation, Vol 1, International Association of Scientific Hydrology Publication No 84 (Unesco-WMO), p 245-252, 1969. 8 p, 1 fig.

Descriptors: *Discharge (Water), *Stage-discharge relations, *Chezy equation, Discharge measurement, Floods, Flood plains, Water levels, Data collections, Streamflow forecasting, Hydrograph analysis, Hydraulics.
Identifiers: Rating curves.

Investigations were made on the development of hydraulic methods of discharge curve extrapolation for discharge sites with and without flood plains. These methods form the basis of design dependences in the extrapolation zone of the curves. The investigations are based on the study of the variation of hydraulic resistance, defined by the coefficient C of Chezy's formula and the water surface slope for different water levels in the channel, and make use of a great amount of data. (Knapp-USGS)
W71-02948

WATER IN MARYLAND: A REVIEW OF THE FREE STATE'S LIQUID ASSETS,
Geological Survey, Towson, Md.
Patrick N. Walker.
Maryland Geological Survey Educational Series No 2, 1970. 52 p, 28 fig, 1 map.

Descriptors: *Water resources, *Maryland, *Hydrologic budget, Water balance, Water utilization, Precipitation (Atmospheric), Evapotranspiration, Surface waters, Streamflow, Water yield, Discharge (Water), Groundwater, Tides, Estuaries, Water quality, Water resources development.

This report is intended to present to the citizens of Maryland an account of the State's water resources. Chapters are titled as though they dealt with parts of a financial budget because water resources must be managed just as finances must be managed. The climate of Maryland is temperate and subhumid. Average annual temperature ranges from about 48 degrees F in the mountains to about 58 degrees F in the southern Coastal Plain. In a typical year the State receives 20,000 billion gallons of water as precipitation of streamflow. In addition, an estimated 130,000 billion gallons of groundwater are contained in the rocks of the state. Maryland's average precipitation is about 42 inches per year. In general, precipitation is higher in the eastern and extreme western parts of the State than it is in the west-central part. Of 42 inches of precipitation each year, about two-thirds or 28 inches is lost to evapotranspiration. Each year about 14,000 billion gallons of water leave the State as streamflow. Some 11,000 billion gallons of this water originates outside of Maryland. Maryland is not in a flood-plagued region and floods are rarely a problem. Maryland's waters are generally of excellent quality. (Knapp-USGS)
W71-03117

A SYSTEMS STUDY OF STORM RUNOFF PROBLEMS IN A NEW TOWN,
Hittman Associates, Columbia, Md. Environmental Sciences and Engineering Dept.
For primary bibliographic entry see Field 06A.
W71-03125

WATER RESOURCES AND RELATED GEOLOGY OF DERA ISMAIL KHAN DISTRICT, WEST PAKISTAN, WITH REFERENCE TO THE AVAILABILITY OF GROUNDWATER FOR DEVELOPMENT,
Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 02F.
W71-03132

CREST-STAGE GAGING STATIONS IN OREGON - A COMPILATION OF PEAK DATA COLLECTED FROM OCTOBER 1952 TO SEPTEMBER 1970,
Geological Survey, Portland, Oreg.
For primary bibliographic entry see Field 07C.
W71-03133

2F. Groundwater

DISTINGUISHING WINTER FROM SUMMER RECHARGE TO GROUNDWATER IN SOUTHERN ARIZONA BY DEUTERIUM ANALYSIS,
Arizona Univ., Tucson; and Geological Survey, Denver, Colo.
E. S. Simpson, David B. Thorud, and Irving Friedman.
In: Symposium on World Water Balance, Vol 1, International Association of Scientific Hydrology Publication No 92, p 100-101, July 1970. 2 p.

Descriptors: *Recharge, *Groundwater basins, *Arizona, *Deuterium, *Tracers, Aquifers, Stable isotopes, Rainfall, Snowmelt, Hydrologic cycle, Weather patterns, Groundwater movement, Sampling, Water wells, Radioactive dating.
Identifiers: Tucson Groundwater Basin.

The Tucson Groundwater Basin in southern Arizona covers an area in excess of 700 square miles, and has an alluvial aquifer more than 1,000 feet thick. The apparent age of groundwater as determined by C-14 analyses ranges from zero (near recharge areas) to about 6,000 years. Average annual precipitation is about 11 inches, slightly more than half of which occurs during the summer as convective storms and most of the remainder during the winter as frontal storms. Summer moisture mostly originates in the Gulf of Mexico and winter moisture mostly comes from the Pacific Ocean. All streams in the basin are intermittent. To estimate the relative importance of winter versus summer precipitation in recharging the Basin, the distribution of deuterium was studied in rainfall, snowmelt, stream flow and groundwater. Fifteen summer storms in 1968 show a weighted average deuterium value of -4.7% (relative to SMOW) and 14 winter storms in 1968-1969 show a weighted average value of -5.8%. Two groundwater samples from wells near a recharge area show -6.6 and -6.3% values. Two other wells in widely separated parts of the valley, tapping much older water, show values of -5.8% each. The deuterium values for most snowfall and snowmelt in the surrounding mountains range from about -6 to -11%. Winter runoff is the dominant factor in producing recharge. (Knapp-USGS)
W71-02769

WATER BALANCE PECULIARITIES OF KARST AREAS,
State Hydrological Inst., Leningrad (USSR).
O. L. Markova.
In: Symposium on World Water Balance, Vol 2, International Association of Scientific Hydrology Publication No 93, p 524-530, July 1970. 7 p, 1 fig, 3 tab, 7 ref.

Descriptors: *Water balance, *Geomorphology, *Surface waters, *Groundwater, Karst, Regions, Hydrologic cycle, Hydrologic budget, Synoptic analysis, Hydrologic data, Climatic data, Meteorological data, River basins, Precipitation (Atmospheric), Runoff, Evapotranspiration, Water storage, International Hydrological Decade, Foreign projects.
Identifiers: *USSR, *Karst areas.

Peculiarities of water balance of regions with covered karst and examples of quantitative estimate of karst effect on river runoff are described. Karst influence on river runoff and its losses depends on the type of karst, on the kind and thickness of covering rocks, on the systems of drainage of rocks on climate, and other physiographical factors. Peculiarities of water balance of karst basins are studied from the combined usage of the two methods: water balance method and method of hydrological comparison. The methods were used to estimate peculiarities of water balance of river basins of some karst regions of the USSR with covered carbonate and sulphatic-carbonate karst. Investigations were based on observational data from hydrometeorological stations and on surveys of some project and research institutes. The results of investigations showed that in slightly dislocated plain karstic regions the difference between the surface and underground water divides of drainage basins up to 1000-2000 sq km is not great. (Woodard-USGS)
W71-02799

INVESTIGATION OF GROUND-WATER RESOURCES IN THE DASHT-MOGHAN AREA, AZARBIJAN, IRAN,
Tehran Regional Water Authority (Iran).
F. Frouzan.
In: Proceedings of Central Treaty Organization Seminar on Evaluation of Water Resources With Scarce Data, March 4-8, 1969, Tehran, Iran, p 395-405, January 1970. 11 p, 6 fig, 3 tab.

Descriptors: *Water resources, *Groundwater, *Water wells, *Foreign projects, Geologic formations, Aquifers, Water quality, Chemical analysis, Soil moisture, Temperature, Surface waters.
Identifiers: *Iran, Scarce data, Surface-water samples, Suspended sediment, Soluble salts, Carbonate hardness.

This paper is a part of the geological study on the pliocene sediment in the Dasht Moghan area of Iran that was carried on by the author from 1965-1966. The purpose of the study is to outline the parts of the Dasht-Moghan area where limited scale withdrawals of fresh water are possible and to delineate the areas that are not favorable for the development of water and irrigation supplies from groundwater. Groundwater areas in the Dasht-Moghan region range from those where there is no fresh water to those where more than 40 meters of fresh water-bearing conglomerate lies between the surface and a depth of 100 meters. In general, two prolific water-bearing conglomerates occur in the Dasht-Moghan area. Many parts of the Dasht-Moghan area would yield fresh water in limited quantities comparable to those withdrawn in the northeast, the most heavily pumped area. In the southeast area, the fresh water is rare. (Woodard-USGS)
W71-02806

ESTIMATING THE VOLUME OF AN AQUIFER BY USING CHLORIDE TRACER,
State Hydraulic Works, Ankara (Turkey). Dept. of Research.
Fuat Senturk.
In: Proceedings of Central Treaty Organization Seminar on Evaluation of Water Resources With Scarce Data, March 4-8, 1969, Tehran, Iran, p 323-340, January 1970. 18 p, 12 fig, 5 tab, 5 ref.

Descriptors: *Water resources, *Groundwater, *Volume, *Foreign projects, Chlorides, Aquifers, Rainfall, Runoff, Seepage, Feeding rates, Water analysis.
Identifiers: *Konya Plain (Turkey), *Chloride tracer.

Methods and results in determining the volume of an aquifer by means of the changes in chloride concentrations in water as applied in Konya Plain, Turkey are given. Only the largest and deepest water-bearing horizons in Konya Plain were studied. Groundwater hydrology in the area, as related to certain chemical constituents, were considered in formulating equations and hydrographs. The method developed gives quite reasonable results under the assumptions made and compares satisfactorily with other existing methods. Konya Plain is 200 km long. Of the 200 or more wells on the plain, 25 were used for observation in this study. The wells are in calcareous rocks, mostly

limestone and conglomerate, and depth to water is between 120 and 200 m. Recharge is from the winter and spring rains on the limestone terrane of the south slopes and causes a decrease in the chloride concentration of the aquifer during the rainy season. Earlier studies indicate that seepage from rainfall amounts to about 25%. Groundwater reserves are estimated to be 30 to 40 x 10 (9th power) cubic meters. (Woodard-USGS)
W71-02810

WATER BALANCE OF NATURAL UNDERGROUND STORAGE,
Water Research Association, Medmenham (England). Hydrology Div.
J. A. Cole.
In: Proceedings of Central Treaty Organization Seminar on Evaluation of Water Resources With Scarce Data, March 4-8, 1969, Tehran, Iran, p 299-322, January 1970. 24 p, 8 fig, 3 tab, 45 ref.

Descriptors: *Groundwater, *Water balance, *Underground storage, *Natural resources, Reviews, Hydrologic data, Aquifers, Analog models, Equations, Discharge, Water wells, Drill holes, Water table.
Identifiers: Research, United Kingdom, Borehole logging.

Methods of data and information acquisition concerning groundwater hydrology are reviewed including reconnaissance by air and ground survey; explorations by drilling, lithological examination and test pumping; operation of hydrometric network by water level and discharge observation and routine sampling for chemical analysis; and exploitation of available resources by planned pumping, possibly with artificial diversion of surface waters to the underground. Analog techniques are described in formulating equations in model studies. Results are included in tables, graphs, and maps. (Woodard-USGS)
W71-02811

SUBSIDENCE AND GROUNDWATER OFFTAKE IN THE BATON ROUGE AREA,
Louisiana Water Resources Research Inst., Baton Rouge.
William A. Wintz, Jr., Raphael G. Kazmann, and Charles G. Smith, Jr.
Available from NTIS as PB-196 311, $3.00 in paper copy, $0.95 in microfiche. Louisiana Water Resources Research Institute Bulletin No 6, October 1970. 90 p, 9 fig, 3 tab, 7 ref, append. OWRR Project A-020-LA (1).

Descriptors: *Groundwater, *Land subsidence, *Water levels, Bench marks, Withdrawal, Groundwater mining, Louisiana, Subsidence, Aquifers, Aquifer characteristics.
Identifiers: Baton Rouge (La).

Precise leveling in the Baton Rouge area during the summer of 1969 showed that the land is subsiding at a variable rate because of groundwater offtake. Between 1964 and 1969, the surface in the heart of the industrial area had sunk 1.3 feet. A map with contour lines of equal subsidence, together with maps of groundwater elevations in the principal aquifers, shows a cause-effect relation. In each of two instances, an isolated area of subsidence outside the principal center of pumping coincides with the location of an individual well field. Additional subsidence of at least 0.4 feet will occur by 1974. If the net offtake from the deep aquifers is not reduced at once, through the importation of water and the artificial recharge and subsequent utilization of the shallow aquifers, the total maximum subsidence in the center of the industrial area could reach 5 feet or more by 1990. The study also indicated that the Baton Rouge fault is active, with the downthrown (south) side dropping at maximum rate of about 0.02 feet per year. The appendix contains descriptions of the 116 benchmarks used in the leveling survey. (Kazmann-LSU)
W71-02828

THE GEOLOGICAL AND HYDROLOGICAL CHARACTERISTICS OF THE WHITEWATER AREA, WISCONSIN,
Wisconsin Univ., Madison. Water Resources Center.
Frank Byrne.
Available from NTIS as PB-196 366, $3.00 in paper copy, $0.95 in microfiche. Wisconsin University Water Resources Center Technical Report, 1970. 86 p, 24 fig, 7 plate, 4 tab, 19 ref. OWRR Project A-013-WIS (1).

Descriptors: *Groundwater, *Geologic investigations, *Hydrologic data, *Water quality, *Wisconsin, Aquifers, Water table, Water levels, Hydrogeology, Drill holes, Water yield, Wells, Geology, Data collections.
Identifiers: *Whitewater area (Wis).

In the Whitewater, Wisconsin area, a study was made of the groundwater hydrology and the geologic factors that influence it. The unconfined groundwater under the eastern part of the Whitewater area is in the Mayville dolomite and Quaternary sediments above the shales of the Maquoketa formation. The confined 'artesian' water of the Zone of Saturation is that water confined to the permeable formations from the Cambrian Mt. Simon sandstone to the Ordovican Galena-Platteville formations. The gradient of the water table is steepest just within the crest of the Whitewater sub-basin divide. In this mile-wide zone the average slope is toward the center of the basin at about 25 feet a mile. Wells in glacial outwash deposits have limited yields and this aquifer is generally best suited to farm supply. The Mayville dolomite is adequate when moderate quantities of water are required but is not capable of major contributions to municipal or industrial supply. The Galena-Platteville unit, because of its closeness to the surface within the Whitewater sub-basin, is a most important source of water for rural supply. The most important reservoirs of groundwater for safe yield in relatively large quantities are the sandstones of the Cambrian system, especially the Mt. Simon sandstone. The average chemical composition of the waters from the local aquifers exhibit strong secondary alkalinity. This is indicative of the effect of beds of dolomite on the infiltrating groundwaters. Only the waters in the Quaternary glacial outwash and the Mayville dolomite show marked deviation from this characteristic. (Woodard-USGS)
W71-02882

SHORT PERIOD VARIATION IN LAND SUBSIDENCE,
Tokyo, Japan.
A. Isigaki, Shauzow Komaki, Takeshi Endo, and Naomi Miyabe.
In: Proceedings of the Tokyo Symposium on Land Subsidence, Vol 2, International Association of Scientific Hydrology and UNESCO, September 1969, Tokyo, p 325-333, 1970. 9 p, 7 fig, 2 tab, 2 ref.

Descriptors: *Subsidence, *Withdrawal, *Land subsidence, Aquifers, Water levels, Water table, Water balance, Surface-groundwater relationships, Seepage, Infiltration, Compaction, Damages, Groundwater, Groundwater movement, Pumping, Soil mechanics, Rock mechanics, Water wells, Water level fluctuations, Hydrogeology.
Identifiers: Tokyo (Japan).

On the records of compaction obtained at several stations in and near Tokyo, fluctuations with nearly diurnal and semidiurnal periods are superimposed on secular advancement of subsidence. These short period fluctuations were analyzed by taking deviations from the 24 hours' moving averages of the hourly values of compaction. The diurnal change is characterized by particularly remarkable daytime swelling of surface soil layer. The swelling of the soil layer appears to be very nearly parallel to the change in barometric pressures and to change in the groundwater level, slightly out of phase (with a lag of 2-3 hours). The terms of tidal changes were also taken out, although the amplitude is far less than that of the diurnal fluctuations. (Knapp-USGS)
W71-02906

ON THE INFLUENCE OF OCEANIC TIDES UPON ARTESIAN HEAD AND SURFACE LEVEL OF LAND,
Saitama Univ., Urawa (Japan). Dept. of Science and Technology.
Shauzow Komaki.
In: Proceedings of the Tokyo Symposium on Land Subsidence, Vol 2, International Association of Scientific Hydrology and UNESCO, September 1969, Tokyo, p 334-342, 1970. 9 p, 1 fig, 6 tab, 4 ref.

Descriptors: *Subsidence, *Withdrawal, *Land subsidence, Aquifers, Water levels, Water table, Water balance, Surface-groundwater relationships, Seepage, Infiltration, Compaction, Damages, Groundwater, Groundwater movement, Pumping, Soil mechanics, Rock mechanics, Water wells, Water level fluctuations, Tidal effects, Tides, Confined water.
Identifiers: Yokkaichi (Japan).

In observations of artesian head and subsidence in and near Yokkaichi, diurnal and semi-diurnal period fluctuations are superposed upon secular variations. After eliminating secular variations, the hourly values of artesian head and land surface were harmonically analyzed by the method of least squares. Similarities of the values in phase lag between oceanic tides and artesian head are found in individual wells. Relations are found between oceanic tides and land surface, somewhate similar. (Knapp-USGS)
W71-02907

PROGRESS REPORT ON GROUNDWATER INVESTIGATION IN IRAN,
Ministry of Water and Power, Tehran (Iran). Div. of Groundwater.
A. Massomi.
In: Proceedings of Central Treaty Organization Seminar on Evaluation of Water Resources With Scarce Data, March 4-8, 1969, Tehran, Iran, p 29-31, January 1970. 3 p.

Descriptors: *Groundwater, *Water resources, *Hydrogeology, *Foreign projects, *Programs, Planning, Water analysis, Bench marks, Gaging stations, Observation wells, Hydrologic data, Meteorological data, Groundwater basins, Subsurface investigations.
Identifiers: *Iran, Project activities, Meteorological stations, Scarce data, Ghanats.

The Government of Iran began considering the problem of groundwater development in 1943, with the creation of the Independent Irrigation Corporation. This report lists a summary of work carried out by the Corporation and ministerial staff and consulting firms from 1958 to January 1969 of 27 regions covering a total area of more than 60,000 square kilometers and reconnaissance survey of 33 other regions. Future programs of the Groundwater Division within the Fourth Development Plan of Iran are listed. Since 1958 investigations have been made of about 8,000 ghanats (gravity flow galleries), 5,500 deep wells, 13,000 shallow wells, and 1,750 springs. About 450 exploratory wells, 6 to 16 in in dia and totaling more than 60,000 m in footage, were drilled, developed, and tested by step drawdown, recovery and interference methods. Also 650 observation wells were drilled and 1,600 privately-owned wells were used for observation of water level changes. The installation of 30 meteorological and 75 stream gaging stations were installed for support of the groundwater studies. Geochemical analyses of 15,000 samples from wells, ghanats and springs were made during the 6 yr since 1963. Future program calls for completion of studies in 2 regions, reconnaissance of 50 alluvial filled basins, determination of groundwater potential in the Karst region of the Zagros Mountains, among other projects. (Lang-USGS)
W71-02913

WATER-LEVEL DATA FROM OBSERVATION WELLS IN THE SOUTHERN HIGH PLAINS OF TEXAS, 1965-70,
Texas Water Development Board, Austin.
For primary bibliographic entry see Field 07C.
W71-02921

GEOHYDROLOGY OF FINNEY COUNTY, SOUTHWESTERN KANSAS,
Geological Survey, Washington, D.C.
Walter R. Meyer, Edwin D. Gutentag, and David H. Lobmeyer.
For sale by Superintendent of Documents, US Government Printing Office, Wash, DC 20402. Geological Survey Water-Supply Paper 1891, 1970. 117 p, 51 fig, 2 plate, 8 tab, 51 ref.

Descriptors: *Hydrogeology, *Aquifers, *Hydrologic budget, *Hydrologic data, *Kansas, Surveys, Data collections, Aquifers, Water resources development, Water levels, Withdrawal, Alluvium, Water quality, Water yield, Irrigation water, Water balance, Recharge.
Identifiers: Finney County (Kans).

In Finney County, southwestern Kansas, the spatial relationships of the subsurface deposits were determined from more than 1,400 sample, drillers', gamma-ray, and laterolog resistivity logs of rotary test holes. The log data were used for lithology of the rock samples, topography of the pre-Pliocene surface, bedrock geology, regional structure, and geologic sections. Unconsolidated sediments of Tertiary and Quaternary age form the principal groundwater reservoir of Finney County and attain a thickness of more than 500 feet in the southwestern part of the county. Recharge to the Tertiary and Quaternary aquifers is principally from dune-sand areas, depressions in the loess, and irrigated areas. Recharge to alluvial deposits is from the Arkansas River, local precipitation, and underflow from the dune sand. The annual recharge averaged approximately 177,000 acre-feet for the period 1955-64. The 1963 rate of pumping was approximately 295,000 acre-feet. The pumping rate caused an overdraft on the reservoir of approximately 167,000 acre-feet. This caused an average drop in water level of 1.5 feet. Water in about half the area is undesirable for domestic purposes because of dissolved-solids content or high fluoride concentrations. (Knapp-USGS)
W71-02923

THE TWICE-USED WATER,
Tor Eigeland.
Aramco World Magazine, November-December 1970, Vol 21, No 6, p 22-29. 28 photos.

Descriptors: *Water reuse, *Irrigation water, *Salinity, *Drainage, Construction, Consumptive use, Saline water, Irrigation practices, Irrigation systems, Sands, Dates, Vegetable crops, Grains (Crops), Irrigated lands, Springs, Artesian wells, Winds, Cultivated lands, Silting, Fresh water, Dunes, Drainage systems, Evaporation, Leaching, Canals, Groundwater, Salt marshes, Channels, Costs, Projects, Withdrawal, Arid lands, Agriculture, Social impact.
Identifiers: *Oases, *Al-Hasa, *Saudi Arabia, Irrigated crops, Dune control, Evaporation lakes.

Twice-used water refers to the saline spring waters of the huge, ancient oasis of al-Hasa in the Eastern Province of Saudi Arabia, 40 miles west of the Arabian Gulf. As this water is reused by farmers for irrigation when it moves from field to field, the crop-killing salinity increases. This oasis--the largest in Saudi Arabia--is an L-shaped collection of many villages and 3 sizeable towns totaling more than 160,000 people. While quality dates have been grown since ancient times, vegetables and grains are now being producted as well. Irrigation water in this rainless area comes from springs and artesian wells and is directed through sluices. Groundwater is pumped from 30 springs at a rate of 237,800 gal/min. Recently, winds have been blasting sand into cultivated areas, driving people out, blocking ancient drainage canals, silting more than 100 freshwater springs, creating salty swamps and covering fertile soil with waves of sand. Dune control techniques, a forestry program, construction of surface and underground drainage channels leading to huge evaporation lakes, a new irrigation system and extensive leaching and fertilization have improved the agricultural situation. A $51 million project is described in which 20,000 ha. were put under irrigation requiring 900 miles each of concrete canals and ditches, 1000 miles of roads and 155 German and 2,200 Saudi workers. Construction is more than 80 percent complete. (Popkin-Arizona)
W71-02959

HYDROLOGY OF LIMESTONE TERRANES - GEOPHYSICAL INVESTIGATIONS,
Geological Survey of Alabama, University.
Thomas J. Joiner, and W. Leon Scarbrough.
Geological Survey of Alabama Bulletin 94, Part D, 1969. 43 p, 23 fig, 9 plate, 100 ref. OWRR B-007-ALA (2).

Descriptors: *Hydrogeology, *Karst, *Geophysics, *Surveys, Electrical studies, Gravity studies, Groundwater movement, Limestones, Fractures (Geology).
Identifiers: Limestone hydrology.

Geophysical methods can sometimes be used successfully to assist in locating, defining, and projecting general trends of solution development in limestone terranes. Geophysical anomalies which can be used as guides for test drilling are: (1) areas where a thick cover of residuum is indicated by seismic surveys; (2) areas where seismic data indicate slower-than-normal bedrock velocities; (3) areas where conductive anomalies are detected within the bedrock by 'horizontal-type' electrical resistivity surveys, and (4) areas where gravity data indicate isolated 'minima' and trends of lower-than-normal gravity values. Reconnaissance geophysical surveys can be used to eliminate unfavorable areas and to indicate areas where efforts of other disciplines should be concentrated. (Knapp-USGS)
W71-03017

HYDROLOGY OF LIMESTONE TERRANES - ANNOTATED BIBLIOGRAPHY OF CARBONATE ROCKS,
Alabama Geological Survey, University.
Philip E. LaMoreaux, Dorothy Raymond, and Thomas J. Joiner.
Copies of this bulletin can be obtained from Librarian, Geological Survey of Alabama, PO Drawer O, University, Alabama 35486. Alabama Geological Survey Bulletin 94, Part A, 1970. 242 p, 2 tab, 462 ref. OWRR Project B-007-ALA (1).

Descriptors: *Bibliographies, *Hydrogeology, *Limestones, *Karst, *Abstracts, *Information retrieval, Groundwater movement, Water chemistry, Water resources, Hydrology, Geochemistry, Geology, Geomorphology, Geophysics, Remote sensing.
Identifiers: *Limestone hydrology.

This annotated bibliography of carbonate rocks was prepared to fill a need for a special compilation. Limestone and dolomite occupy roughly one-fifth of the area of the earth and, in places, contain large quantities of groundwater, petroleum and natural gas, and valuable reserves of metals. This bibliography is composed of references to the geology, the hydrology, the geochemistry, and the geophysics of carbonate rocks and to selected closely related subjects. Citations are listed alphabetically by principal author and numerically by document numbers. The Subject Index contains a two-level term set following a system devised by the Geological Survey of Alabama. The Location Index is by individual states of the United States and by country. Each index lists the citations by document number. The references are also stored using an IBM 360 Model 50 computer. This stored information is available through application to the Geological Survey of Alabama. The computer is also programmed to retrieve citations by geological age. Each reference is encoded numerically under the subject, the geographic location, the geologic age, and description codes, as well as by author and date of publication. (See also W71-03017). (Knapp-USGS)
W71-03109

NITRATE AND AMMONIUM CONTENTS OF WISCONSIN LIMESTONES,
Wisconsin Univ., Madison. Dept. of Soil Science.
For primary bibliographic entry see Field 02K.
W71-03111

WATER IN MARYLAND: A REVIEW OF THE FREE STATE'S LIQUID ASSETS,
Geological Survey, Towson, Md.
For primary bibliographic entry see Field 02E.
W71-03117

WATER RESOURCES AND RELATED GEOLOGY OF DERA ISMAIL KHAN DISTRICT, WEST PAKISTAN, WITH REFERENCE TO THE AVAILABILITY OF GROUNDWATER FOR DEVELOPMENT,
Geological Survey, Washington, D.C.
James W. Hood, Lutfe Ali Khan, and Khalid Jawaid.
For sale by Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402. Geological Survey Water-Supply Paper 1608-K, 1970. 74 p, 16 fig, 6 plate, 10 tab, 20 ref.

Descriptors: *Water resources development, *Irrigation water, *Hydrogeology, Water balance, Aquifers, Alluvium, Water quality, Data collections, Hydrologic data, Surface waters, Streamflow, Water yield, Water wells.
Identifiers: *Pakistan, *Dera Ismail Khan (Pakistan).

Dera Ismail (D.I.) Khan District contains an area of 3,450 square miles between the right bank of the Indus River and the Sulaiman Range in west-central West Pakistan. The region is semiarid with an average annual rainfall of about 9 inches and a potential evapotranspiration rate of eight to nine times the annual rainfall. D.I. Khan District is primarily an alluvial plain. Indus River alluvium penetrated by test holes and tubewells consists predominantly of sand, which in tubewells can yield from 2 to 3 cfs of water with only moderate drawdown. Also in this belt, groundwater of good chemical quality extends to depths of 1,000 feet or more. The area from the mouth of the Gumal River gorge to the vicinity of Kot Azam contains sand and gravel strata that may yield from 1 to 3 cfs of water, which contains 500 to 1,500 ppm of total dissolved solids. The central part of the District contains highly mineralized water and few aquifers. Under present conditions, surface-water supplies are fully utilized, and groundwater is the largest supply available for development. (Knapp-USGS)
W71-03132

GROUNDWATER ANALOGUES,
Melbourne Univ., Parkville (Australia). Dept. of Agricultural Engineering.
J. D. Lawson, and A. K. Turner.
In: Proceedings of Groundwater Symposium, New South Wales University, Manly Vale, Australia, August 28-29, 1969: New South Wales University Water Research Laboratory Report No 113, Paper No 7, p 106-124, April 1970. 19 p, 24 ref.

Descriptors: *Mathematical models, *Analog models, *Groundwater movement, *Computer models, *Hydraulic models, Reviews, Model studies, Digital computers, Analog computers, Simulation analysis, Drawdown, Pumping, Water yield, Water wells, Withdrawal, Aquifers.
Identifiers: Groundwater modeling.

Hydraulic models and computer models for solving groundwater movement problems are reviewed. In general, mathematical solutions of groundwater flow regions are impossible due to the complexity of the governing field equation and the usually complicated boundaries of the region to be analyzed. However, with the present availability of high speed, large storage digital computers, numerical solutions of flow fields are readily attainable. Electrical-network analogs can be used to model both confined and unconfined groundwater systems. Aquifer properties and boundary parameters can be electrically simulated and varied, and function generators are available to provide the effects of discharge and recharge wells, spreading grounds, springs, and net infiltration from rainfall in aquifers of varying transmissibility. Three different types of analog discussed in detail are membrane electrical network, and Hele-Shaw analogs. (Knapp-USGS)
W71-03135

WASTE WATER RECLAMATION USING GROUNDWATER RECHARGE - A REVIEW,
New South Wales Univ., Kensington (Australia). School of Civil Engineering.
For primary bibliographic entry see Field 04B.
W71-03136

HYDROGEOLOGIC ELECTRIC ANALOGUE MODELS CONSTRUCTED BY THE SOUTH AUSTRALIAN MINES DEPARTMENT,
South Australia Dept. of Mines.
D. McPharlin.
In: Proceedings of Groundwater Symposium, New South Wales University, Manly Vale, Australia, August 28-29, 1969: New South Wales University Water Research Laboratory Report No 113, Paper No 8, p 125-132, April 1970. 8 p, 1 ref.

Descriptors: *Analog models, *Resistance networks, Computer models, Water resources development, Model studies, Water yield, Water management (Applied), Irrigation water.
Identifiers: *Australia.

Analog models are a useful aid to hydrogeology studies in Australia. The Adelaide Plains Model and two additional studies of areas of South Australia which contain major water resources are discussed. The models are constructed of discrete resistors and capacitors assembled in a regular network on a pegboard base. The resistors are selected so that their values are inversely proportional to the transmissivity of the portion of the aquifer they represent. Once these conditions have been satisfied the choice of time scale for the model fixes the size of the capacitor which must be used at each resistor junction to produce the electrical equivalent of storage factor. (Knapp-USGS)
W71-03137

DIGITAL MODELS IN REGIONAL GROUNDWATER STUDIES,
New South Wales Univ., Kensington (Australia). School of Civil Engineering.
D. H. Pilgrim.
In: Proceedings of Groundwater Symposium, New South Wales University, Manly Vale, Australia, August 28-29, 1969: New South Wales University Water Research Laboratory Report No 113, Paper No 9, p 133-151, April 1970. 19 p, 4 fig, 37 ref.

Descriptors: *Model studies, *Groundwater movement, *Digital computers, *Analog models, *Reviews, Water resources development, Hydrogeology, Simulation analysis.
Identifiers: *Australia.

Digital models have been developed for analysis and simulation of groundwater flow. The general approach and computational procedures used in these models are outlined, and applications are reviewed. Comparison of the digital and electric analog methods shows that digital models have several advantages, and that these should be enhanced by future developments. More widespread observation well records are desirable if digital models are to be applied in Australia. (Knapp-USGS)
W71-03138

SYSTEM MODELLING FOR CONJUNCTIVE USE OF A GROUNDWATER AQUIFER AND A SURFACE RESERVOIR,
New South Wales Univ., Kensington (Australia). School of Civil Engineering.
For primary bibliographic entry see Field 04B.
W71-03139

LAND SUBSIDENCE; PROCEEDINGS OF THE TOKYO SYMPOSIUM, SEPTEMBER 1969.

International Association of Scientific Hydrology, Tokyo, 1970. 2 volumes.

Descriptors: *Subsidence, *Withdrawal, *Land subsidence, Aquifers, Water levels, Water table, Water balance, Surface-groundwater relationships, Seepage, Infiltration, Compaction, Damages, Groundwater, Groundwater movement, Pumping, Soil mechanics, Rock mechanics, Water wells, Soil water, Soil water movement, Hydrogeology, Clays, Rheology.
Identifiers: *Japan.

The problems of land subsidence are discussed in symposium proceedings of 67 papers. These phenomena have had what may be called catastrophic results. Although no limit had been placed upon the type of subsidence to be studied, most of the Japanese and American authors paid particular attention to subsidence caused by the lowering of water-tables or by the exploitation of oil fields. Theory has advanced very far in these spheres, thanks to study of the compaction of strata, considered as a mechanical problem. Some of the papers, however, attributed land subsidence to other causes, such as the dissolution of limestone deposits, the working of mines, or purely tectonic movements. The influence of soil components (sand, clay, loess, peat, etc.) interested some researchers. The action of hurricanes and tides was also considered, particularly by Japanese specialists. A number of contributions were confined to the effects of subsidence upon surface and subsoil hydrology, irrespective of its causes. Appropriate means of reducing subsidence were considered. (See also W71-03149 thru W71-03182) (Knapp-USGS)
W71-03148

DIRECTIONS OF RESEARCH ON LAND SUBSIDENCE,
Komazawa Univ., Tokyo (Japan).
Naomi Miyabe.
In: Proceedings of the Tokyo Symposium on Land Subsidence, Vol 1, International Association of Scientific Hydrology and UNESCO, September 1969, Tokyo, p 1-11, 1970. 11 p, 8 fig, 11 ref.

Descriptors: *Subsidence, *Withdrawal, *Land subsidence, Aquifers, Water levels, Water table, Water balance, Surface-groundwater relationships, Seepage, Infiltration, Compaction, Damages, Groundwater, Groundwater movement, Pumping, Soil mechanics, Rock mechanics, Water wells, Soil water, Soil water movement, Hydrogeology, Clays, Rheology.
Identifiers: *Japan.

Investigations of land subsidence are reviewed and further research on this subject is recommended: (1) to develop laboratory experiments on models and analogs; (2) to extend chemical and mineralogical analyses of soil; (3) to extend hydrological studies on aquifers underneath wider areas including land subsidence areas; and (4) to extend studies on the compaction of deep seated soil layers. The results of advanced studies will be more help in designing preventive measures against land subsidence. (See also W71-03148) (Knapp-USGS)
W71-03149

STATUS OF PRESENT KNOWLEDGE AND NEEDS FOR ADDITIONAL RESEARCH ON COMPACTION OF AQUIFER SYSTEMS,
Geological Survey, Sacramento, Calif.
J. F. Poland.
In: Proceedings of the Tokyo Symposium on Land Subsidence, Vol 1, International Association of Scientific Hydrology and UNESCO, September 1969, Tokyo, p 11-21, 1970. 11 p, 2 fig, 1 tab, 29 ref.

Descriptors: *Subsidence, *Withdrawal, *Land subsidence, Aquifers, Water levels, Water table, Water balance, Surface-groundwater relationships, Seepage, Infiltration, Compaction, Damages, Groundwater, Groundwater movement, Pumping, Soil mechanics, Rock mechanics, Water wells, Mathematical models, Soil water movement, Hydraulic conductivity.
Identifiers: Aquifer systems.

The deposits that are compacting in many areas of major subsidence are relatively unconsolidated, chiefly alluvial and lacustrine sediments, of late Cenozoic age, in confined aquifer systems of heterogeneous texture. Parameters needed to predict compaction include compressibility, initial stress, change in stress, number and thickness of compressible beds, and vertical hydraulic conductivity. Compaction is computed from laboratory test results on cores, or derived for the entire aquifer system from field stress-strain relations. Methods used to measure compaction (or expansion) of sediments include bench-marks, extensometers, periodic casing-collar logging, and periodic measurement of emplaced radioactive bullets. Additional research is needed on the effect of multi-cyclic loading, improvement of field methods for determining compressibility of aquifer systems, measuring compaction and pore pressures, estimating preconsolidation loads, and development of mathematical and electronic models capable of simulating compaction of confined aquifer systems. (See also W71-03148) (Knapp-USGS)
W71-03150

LAND SUBSIDENCE PROBLEMS IN TAIPEI BASIN,
Jui-Ming Hwang, and Chian-Min Wu.
In: Proceedings of the Tokyo Symposium on Land Subsidence, Vol 1, International Association of Scientific Hydrology and UNESCO, September 1969, Tokyo, p 21-34. 14 p, 8 fig, 2 tab, 3 ref.

Descriptors: *Subsidence, *Withdrawal, *Land subsidence, Aquifers, Water levels, Water table, Water balance, Surface-groundwater relationships, Seepage, Infiltration, Compaction, Damages, Groundwater, Groundwater movement, Pumping, Soil mechanics, Rock mechanics, Water wells.
Identifiers: *Taiwan.

Releveling of bench marks in 1968 and 1969 indicates that subsidence of the land surface in the Taipei Basin, Taiwan is more than 1.3 meters. In the sharp subsidence area, subsidence which was as much as 0.6 meter in 1966 now has about doubled. The maximum rate of subsidence in recent years was about 25 cm a year. Plots of subsidence against decline in artesian pressure suggest that pressure decline is a major cause of the subsidence. Consolidation data are used to verify the relationship between the pressure drop and the subsidence. However, other causes such as compaction of soil, tectonic adjustment and loading at land surface may have contributed to the subsidence. (See also W71-03148) (Knapp-USGS)
W71-03151

LAND-SURFACE SUBSIDENCE IN THE HOUSTON-GALVESTON REGION, TEXAS,
Geological Survey, Houston, Tex.
Robert K. Gabrysch.
In: Proceedings of the Tokyo Symposium on Land Subsidence, Vol 1, International Association of Scientific Hydrology and UNESCO, September 1969, Tokyo, p 43-54, 1970. 12 p, 9 fig, 4 ref.

Descriptors: *Subsidence, *Withdrawal, *Land subsidence, Aquifers, Water levels, Water table, Water balance, Surface-groundwater relationships, Seepage, Infiltration, Compaction, Damages, Groundwater, Groundwater movement, Pumping, Soil mechanics, Rock mechanics, Water wells.
Identifiers: *Houston (Tex), *Galveston (Tex).

In the Houston-Galveston region of Texas, the principal cause of land-surface subsidence is the lowering of pressure heads due to the removal of water and oil from subsurface strata. This paper emphasizes the effects of removal of water. The region is underlain by a thick section of unconsolidated lenticular deposits of sand and clay. Clays separating beds of sand retard the vertical movement of water, creating artesian conditions within the aquifers. The ration of sand to clay, which is a major factor controlling the degree of compaction, varies from place to place in the aquifers. Reduction of pressure due to withdrawal of water causes additional load to be transferred to the skeleton of the aquifer system, causing compaction. As much as 5 feet of subsidence occurred in the Houston-Galveston region between 1943 and 1964, and as much as 200 feet of water-level decline occurred during the same period. The rate of subsidence increased from about 0.2 foot per year during the 1954-59 to about 0.24 foot per year during the 1959-64 period. The decline in water levels increased from about 4 feet per year to about 7 feet per year in those same periods. (See also W71-03148) (Knapp-USGS)
W71-03152

SURFACE DEFORMATION ASSOCIATED WITH OIL AND GAS FIELD OPERATIONS IN THE UNITED STATES,
Geological Survey, Menlo Park, Calif.
R. F. Yerkes, and R. O. Castle.
Partial support by U S Atomic Energy Comm. In: Proceedings of the Tokyo Symposium on Land Subsidence, Vol 1, International Association of Scientific Hydrology and UNESCO, September 1969, Tokyo, p 55-66, 1970. 12 p, 6 fig, 1 tab, 15 ref.

Descriptors: *Subsidence, *Withdrawal, *Land subsidence, *Oil fields, Aquifers, Oil wells, Oil reservoirs, Compaction, Damages, Groundwater, Groundwater movement, Mining, Pumping, Soil mechanics, Rock mechanics, Faults (Geology), Fractures (Geology).
Identifiers: *Salt domes, *Oil-field subsidence.

Surface deformation associated with oil and gas field operations in the United States consists of (1) differential subsidence centering on the fields, (2) centripetally directed horizontal displacements, and (3) faulting. Faulting is commonly high-angle, normal, and peripheral to the subsidence bowl (Goose Creek and Mykawa, Texas; Inglewood and Kern Front, California), but may be low-angle, reverse, and central Buena Vista, California). Strain patterns developed over these fields are similar to those over a Texas salt dome where all three surface effects were observed during Frasch extraction of sulfur. In this case, a central compressional zone extended out to beyond the 0.35 S isobase (S — maximum subsidence) and a surrounding tensional zone extended to the periphery of the bowl, where high-angle normal faulting occurred. (See also W71-03148) (Knapp-USGS)
W71-03153

SUBSIDENCE IN THE WILMINGTON OIL FIELD, LONG BEACH, CALIFORNIA, U.S.A.,
Long Beach Dept. of Oil Properties, Calif.
M. N. Mayuga, and D. R. Allen.
In: Proceedings of the Tokyo Symposium on Land Subsidence, Vol 1, International Association of Scientific Hydrology and UNESCO, September 1969, Tokyo, pp 66-79, 1970. 14 p, 16 fig, 5 ref.

Descriptors: *Subsidence, *Withdrawal, *Land subsidence, *Oil fields, Aquifers, Oil wells, Compaction, Damages, Groundwater, Groundwater movement, Mining, Pumping, Soil mechanics, Rock mechanics, Water wells, Injection wells, Injection, Secondary recovery (Oil), Injection wells.
Identifiers: *Wilmington Oil Field (Calif), *Oil-field subsidence.

The Long Beach subsidence area, California, is an elliptical bowl superimposed on top of California's largest oil giant, the Wilmington Oil Field. The center of the bowl has subsided over 9 meters since 1926. Horizontal and vertical movements have caused extensive damage to wharves, pipelines, buildings, streets, bridges and oil wells, necessitating costly repairs and remedial work, including the raising of land surface areas to prevent inundation by the sea. Remedial costs have already exceeded US$100 million. Withdrawal of fluids and gas and the consequent reduction of subsurface pressures in the reservoirs caused compaction in the oil zones. A massive repressurization program, by injection of salt water into the oil reservoirs, reduced the subsidence area from approximately 50 sq. kilometers to 8 sq. kilometers. The rate of subsidence at the historic center of the bowl was reduced from a maximum of 75 cm per year in 1952 to 0.0 cm in 1968. A small surface rebound occurred in areas of heaviest water injection. (See also W71-03148) (Knapp-USGS)
W71-03154

LAND SUBSIDENCE IN THE TOKYO DELTAIC PLAIN,
Tokyo Metropolitan Univ. (Japan). Dept. of Science and Engineering.
Takamasa Nakano, Hiroshi Radomura, and Tware Matsuda.
In: Proceedings of the Tokyo Symposium on Land Subsidence, Vol 1, International Association of Scientific Hydrology and UNESCO, September 1969, Tokyo, p 80-87, 1970. 8 p, 5 fig, 1 tab.

Descriptors: *Subsidence, *Withdrawal, *Land subsidence, Aquifers, Water levels, Water table, Water balance, Surface-groundwater relationships, Seepage, Infiltration, Compaction, Damages, Groundwater, Groundwater movement, Pumping, Soil mechanics, Rock mechanics, Water wells, Hydrogeology.
Identifiers: *Tokyo (Japan).

Land subsidence in Tokyo has been caused mainly by the compaction of soft clayey layers within aquifers subject to over-pumping of groundwater. Compaction is progressing not only in Alluvium, but also in Diluvium. The amount of land subsidence is the sum of compaction of alluvium and of the layers below alluvium. The relationship between the amount of land subsidence and thickness of Alluvium is clear, particularly in the case of land subsidence due to pumping of groundwater from alluvium and upper diluvium. (See also W71-03148) (Knapp-USGS)
W71-03155

REVIEWS OF LAND SUBSIDENCE RESEARCHES IN TOKYO,
Tokyo Inst. of Civil Engineering (Japan).
Yoshi Inaba, Iwao Abe, Susumu Iwasaki, Shigeru Aoki, and Takeshi Endo.
In: Proceedings of the Tokyo Symposium on Land Subsidence, Vol 1, International Association of Scientific Hydrology and UNESCO, September 1969, Tokyo, p 87-98, 1970. 12 p, 8 fig, 1 tab.

Descriptors: *Subsidence, *Withdrawal, *Land subsidence, Aquifers, Water levels, Water table, Water balance, Surface-groundwater relationships, Seepage, Infiltration, Compaction, Damages, Groundwater, Groundwater movement, Pumping, Soil mechanics, Rock mechanics, Water wells.
Identifiers: *Tokyo (Japan).

Land subsidence in the lowland of Tokyo was discovered as a result of repeated precise levelling in 1924 to study the post-seismic crustal disturbance associated with the Kwanto Earthquake of 1923. This paper is a historical review of the progress of the land subsidence phenomena in Tokyo. Recently, in spite of control of groundwater withdrawalland subsidence and overall-lowering of the groundwater table have continued, and the area of subsidence has been extending towards surrounding lowland and upland areas. Lower pleistocene deposits which contain abundant confined water are widely distributed within the large sedimentary basin of the southern Kwanto region. Removal of groundwater in these deposits has a close relationship with the land subsidence. (See also W71-03148) (Knapp-USGS)
W71-03156

RESULTS OF REPEATED PRECISE LEVELLINGS IN LAND SUBSIDENCE AREA IN TOKYO,
Tokyo Inst. of Civil Engineering (Japan); and Komazawa Univ. (Tokyo).
Susumu Iwasaki, Ryozo Kaido, and Naomi Miyabe.
In: Proceedings of the Tokyo Symposium on Land Subsidence, Vol 1, International Association of Scientific Hydrology and UNESCO, September 1969, Tokyo, p 98-105, 1970. 8 p, 6 fig, 2 ref.

Descriptors: *Subsidence, *Withdrawal, *Land subsidence, Aquifers, Water levels, Water table, Water balance, Surface-groundwater relationships, Seepage, Infiltration, Compaction, Damages, Groundwater, Groundwater movement, Pumping, Soil mechanics, Rock mechanics, Water wells, Hydrogeology.
Identifiers: *Tokyo (Japan).

The amounts of land subsidence in the Koto region of Tokyo have been measured once a year by repeating precise levelling. The gradual expansion of the subsidence area was studied by analogy with the phenomenon of diffusion. The local values of constants D, analogs to the diffusion constant, are calculated and their distributions are examined. As a result, the distribution of D thus obtained may be regarded as some indication of underground hydrogeological structures which are closely related to the occurrence of land subsidence. One of the parameters considered as the controlling factor is the permeability of the aquifer, multiplied by the gradient of groundwater pressure, which describes the lateral flow of groundwater according to Darcy's law. The distribution of D may therefore be some indication of the distribution of the groundwater flow or distribution of the permeability within the aquifer concerned. (See also W71-03148) (Knapp-USGS)
W71-03157

LAND SUBSIDENCE IN OSAKA,
Kyoto Univ. (Japan). Disasters Prevention Research Inst.
S. Murayama.
In: Proceedings of the Tokyo Symposium on Land Subsidence, Vol 1, International Association of Scientific Hydrology and UNESCO, September 1969, Tokyo, p 105-130, 1970. 26 p, 5 fig, 4 tab, 6 ref.

Descriptors: *Subsidence, *Withdrawal, *Land subsidence, Aquifers, Water levels, Water table, Water balance, Surface-groundwater relationships, Seepage, Infiltration, Compaction, Damages, Groundwater, Groundwater movement, Pumping, Soil mechanics, Rock mechanics, Water wells, Hydrogeology.
Identifiers: *Osaka (Japan).

One of the typical examples of land subsidence in Japan can be seen in Osaka city, where the maximum subsidence amounts to about 2.5 m during the last 25 years. Such remarkable ground subsidence is due mainly to the consolidation of clay strata caused by decrease in the artesian pressure. There was a close correspondence between the level of groundwater and the actual rate of subsidence. When the water level recovered, the subsidence became slight and sometimes it stopped. The distribution of pre-consolidation pressure in the normally consolidated alluvial clay in Osaka follows the decrease in the artesian head in the aquifer. (See also W71-03148) (Knapp-USGS)

W71-03158

ANALYSIS OF LAND SUBSIDENCE IN NIIGATA,
Ministry of Transportation, Yokosuka (Japan). Port and Harbor Research Inst.
Tatsuro Okumura.
In: Proceedings of the Tokyo Symposium on Land Subsidence, Vol 1, International Association of Scientific Hydrology and UNESCO, September 1969, Tokyo, p 130-143, 1970. 14 p, 8 fig, 6 ref.

Descriptors: *Subsidence, *Withdrawal, *Land subsidence, Aquifers, Water levels, Water table, Water balance, Surface-groundwater relationships, Seepage, Infiltration, Compaction, Damages, Groundwater, Groundwater movement, Pumping, Soil mechanics, Rock mechanics, Water wells, Natural gas, Hydrogeology.
Identifiers: *Niigata (Japan).

Land subsidence in the Niigata area of Japan was analyzed by means of consolidation theory. Pumping the underground water from the deep sandy layers for extracting methane gas caused a time-dependent loading of the clay layers. An analytical solution of consolidation under the load increasing linearly with time was obtained in terms of the vertical strain. A numerical method of analysis for the load decreasing linearly and then becoming constant was developed considering the difference in values of soil constants for consolidation and for rebound. These two methods were combined for analyzing the subsidence in the Niigata area, and the results compared favorably with the observed settlement. (See also W71-03148) (Knapp-USGS)
W71-03159

TRITIUM DATING OF LAND SUBSIDENCE IN NIIGATA,
Shigehiko Kimura, Masayuki Wada, Hironao Kawasaki, and Hisoshi Shiina.
In: Proceedings of the Tokyo Symposium on Land Subsidence, Vol 1, International Association of Scientific Hydrology and UNESCO, September 1969, Tokyo, p 185-192, 1970. 8 p, 5 fig, 1 tab.

Descriptors: *Subsidence, *Withdrawal, *Land subsidence, Aquifers, Water levels, Water table, Water balance, Surface-groundwater relationships, Seepage, Infiltration, Compaction, Damages, Groundwater movement, Pumping, Soil mechanics, Rock mechanics, Water wells, Hydrogeology, Radioactive dating, Tritium, Groundwater.
Identifiers: *Niigata (Japan).

In order to know the influence of the pumping of groundwater on land subsidence in the Niigata area, an accurate evaluation of the groundwater flow in the area is required. The tritium dating method was applied to the evaluation. The groundwater flow into the area and the characteristics of the groundwater flow within the area were clarified. The results have given information for establishing models of the land subsidence from the viewpoint of both hydraulics and soil engineering. This method, when applied to a longer period, was proved to be an appropriate technique for not only a more detailed indication of groundwater flow, but also the quantitative estimation of the changes of the flow in the future, based on the quantitative groundwater flow and the results of hydraulic computation. Natural gas dissolved in water in the Alluvium, 40 to 150 m in depth, enclosed by an impervious bed as thick as 20 m, is removed along with water. The pumped water is derived from (1) the groundwater flow of about 2 km/year from the upstream side, (2) the inflow from its underlier, and (3) lateral flow and infiltration of rain water. (See also W71-03148) (Knapp-USGS)
W71-03160

SHRINKAGE OF SUBAQUEOUS SEDIMENTS OF LAKE IJSSEL (THE NETHERLANDS) AFTER RECLAMATION,
Yssel Lake Development Authority, Kampen (Netherlands).
R. J. de Glopper.
In: Proceedings of the Tokyo Symposium on Land Subsidence, Vol 1, International Association of Scientific Hydrology and UNESCO, September 1969, Tokyo, p 192-201, 1970. 10 p, 4 fig, 6 ref.

Descriptors: *Subsidence, *Withdrawal, *Land subsidence, Aquifers, Water levels, Water table, Water balance, Surface-groundwater relationships, Seepage, Infiltration, Compaction, Damages, Groundwater, Groundwater movement, Pumping, Soil mechanics, Rock mechanics, Water wells, Drying, Drainage engineering, Land reclamation.
Identifiers: *Lake IJssel (Netherlands), *Polders.

The very soft subaqueous sediments on the bottom of Lake IJssel are subject to a considerable shrinkage after reclamation. This is brought about by a contraction of the soil, mainly due to high capillary potentials during the growing season. The prediction is done by comparing the specific volumes of the original sediments with samples of the same type of sediments, which were reclaimed about 100 years ago. Shrinkage increases with increasing clay content and decreases with increasing depth of the layer concerned. A graph shows the relation between the original thickness of the soft layers and 100 years after reclamation at clay contents varying from 5 to 60% and at intervals of 5%. (See also W71-03148) (Knapp-USGS)
W71-03161

THE HYDROLOGIC BALANCE IN THE LAND SUBSIDENCE PHENOMENA,
Research Inst. for Natural Resources, Tokyo (Japan); Kokusai Aerial Surveys Co. Ltd., Tokyo (Japan); and Tokyo Univ. (Japan). Dept. of Engineering.
Tatsuo Shibasaki, A. Kamata, and Shizuo Shindo.
In: Proceedings of the Tokyo Symposium on Land Subsidence, Vol 1, International Association of Scientific Hydrology and UNESCO, September 1969, Tokyo, p 201-215, 1970. 15 p, 13 fig.

Descriptors: *Subsidence, *Withdrawal, *Land subsidence, Aquifers, Water levels, Water table, Water balance, Surface-groundwater relationships, Seepage, Infiltration, Compaction, Damages, Groundwater, Groundwater movement, Pumping, Soil mechanics, Rock mechanics, Water wells.
Identifiers: *Japan.

The hydrologic balance in confined grounwater basins was studied in the land subsidence areas in Japan. The results of computations show that the leakage is estimated to be about 60 to 70% of the total recharge to the basin. These values of leakage ratios will be useful in solving the problems in the land subsidence area. Samples of confined groundwater were taken for tritium analysis. The tritium content of samples ranged from 0.2 to 0.3 T. U., indicated apparently a poor recharge from the outcrop area to the basin. (See also W71-03148) (Knapp-USGS)
W71-03162

NIIGATA GROUND SUBSIDENCE AND GROUNDWATER CHANGE,
Takuzo Hirono.
In: Proceedings of the Tokyo Symposiun on Land Subsidence, Vol 1, International Association of Scientific Hydrology and UNESCO, September 1969, Tokyo, p 144-161, 1970. 18 p, 13 fig, 1 tab.

Descriptors: *Subsidence, *Withdrawal, *Land subsidence, Aquifers, Water levels, Water table, Water balance, Surface-groundwater relationships, Seepage, Infiltration, Compaction, Damages, Groundwater, Groundwater movement, Pumping, Soil mechanics, Rock mechanics, Water wells, Natural gas, Hydrogeology.
Identifiers: *Niigata (Japan).

Periodogram and Fourier analysis were applied to the data obtained from observation wells installed for measuring ground subsidence at Yamanoshita ward, Niigata City, Japan in 1958. The items of data analyzed are the sea level at the harbor and the atmospheric pressure at the meteorological observatory in addition to the ground subsidence and the groundwater level at the observation wells. The analyses were made for the period from July to October, 1958 (about 120 days). The ground surface changes periodically with the groundwater. For shorter periods (less than 30 days) the ground surface undulates with amplitude proportional to that of the groundwater without any significant phase-lag. The longer the period (over 100 days), the later becomes the motion of the ground with respect to the groundwater, up to 90 deg out of phase. The permeability of the soil is inversely proportional to the period. (See also W71-03148) (Knapp-USGS)
W71-03163

SUBSIDENCE IN THE NORTH GERMAN COASTAL REGION,
R. Dolezal, and M. Petersen.
In: Proceedings of the Tokyo Symposium on Land Subsidence, Vol 1, International Association of Scientific Hydrology and UNESCO, September 1969, Tokyo, p 35-42, 1970. 8 p, 9 fig, 12 ref.

Descriptors: *Subsidence, *Withdrawal, *Land subsidence, Aquifers, Water levels, Water table, Water balance, Surface-groundwater relationships, Seepage, Infiltration, Compaction, Damages, Groundwater, Groundwater movement, Pumping, Soil mechanics, Rock mechanics, Water wells, Surveys.
Identifiers: *Germany.

Subsidence was measured in Holocene sea- and river-marshes blocked by dykes against floods of sea water and brackish river water. The soils of the sea marshes consist mainly of pure sand and more or less organic components (silt and clay). In the river marshes organic components (bog and peat) predominate. Fixed pipe supports and plates free to move with subsidence are used to measure settlement. The pipes are inserted through the Holocene stratum into the pleistocene. Near the fixed pipes, plates are located 25 centimeters below the land surface. Each year the height of the fixed pipe and the relative level of the plates is determined. Graphs of the relative height with time indicate the progress of the settlement. These measurements are complemented by observing the groundwater level. (See also W71-03148) (Knapp-USGS)
W71-03164

A LINEAR RELATIONSHIP BETWEEN LIQUID PRODUCTION AND OIL-FIELD SUBSIDENCE,
Geological Survey, Menlo Park.
R. O. Castle, R. F. Yerkes, and F. S. Riley.
Partial support for this study was provided by the Div of Reactor Development and Technology, U S Atomic Energy Comm. In: Proceedings of the Tokyo Symposium on Land Subsidence, Vol 1, International Association of Scientific Hydrology and UNESCO, September 1969, Tokyo, p 162-173, 1970. 12 p, 6 fig, 9 ref.

Descriptors: *Subsidence, *Withdrawal, *Land subsidence, *Oil fields, Aquifers, Oil reservoirs, Compaction, Damages, Groundwater, Groundwater movement, Mining, Pumping, Soil mechanics, Rock mechanics, Water wells, Oil wells.
Identifiers: *Oil-field subsidence.

Correlations between production and subsidence in the Inglewood oil field of California indicate that subsidence has varied approximately linearly with net liquid production. Similar relations in three Venezuelan fields and the Wilmington and Huntington Beach fields in California, suggest that this linearity may be a general phenomenon. The ratio of volume of subsidence to volume of liquid production ranges from 0.08 in the Inglewood field to nearly 1 in one Venezuelan field. Early production stages commonly have been characterized by non-linearity. If compaction is considered a linear function of effective stress over the relevant stress range, simple analogy with a tightly confined arte-

sian system (where production must derive from liquid expansion and/or reservoir compaction) indicates that the ratio should remain: (1) constant and close to zero for those fields characterized by slightly compressible reservoir materials; and (2) constant and close to but less than 1 for those fields characterized by highly compressible reservoir materials. Changes in the ratio through time may be related to changes in the produced gas/liquid ratio. (See also W71-03148) (Knapp-USGS)
W71-03165

EFFECTS OF MINING SUBSIDENCES ON THE GROUNDWATER AND REMEDIAL MEASURES,
Bochum Univ. (West Germany).
B. Wohlrab.
In: Proceedings of the Tokyo Symposium on Land Subsidence, Vol 2, International Association of Scientific Hydrology and UNESCO, September 1969, Tokyo, p 502-512, 1970. 11 p, 10 fig, 5 ref.

Descriptors: *Subsidence, *Withdrawal, *Land subsidence, *Drainage engineering, Aquifers, Water levels, Water table, Water balance, Surface-groundwater relationships, Seepage, Infiltration, Compaction, Damages, Groundwater, Groundwater movement, Mining, Pumping, Soil mechanics, Rock mechanics, Water wells, Drainage systems.
Identifiers: *Germany.

Mining subsidence in Germany have an important influence on the water cycle and on the cultivation of land. In addition to flooding, other components of ground movements also disorder water utilization directly or indirectly. Elongations, compressions, displacements and subsidence slope are a disadvantage for hydraulic engineering, as well as for drainage and irrigation works. An artificially created drainage of water and a suitable groundwater level for the subsidence area can be successful in the long run only if the ground movements stop. If ground movements continue, a pumping station is necessary. In spite of the artificially created flow of water, with or without a pumping station, drainage of subsidence troughs will remain difficult so long as ground movements go on. (See also W71-03148) (Knapp-USGS)
W71-03166

SURFACE SUBSIDENCE AND SINKHOLES IN THE DOLOMITIC AREAS OF THE FAR WEST RAND, TRANSVAAL, REPUBLIC OF SOUTH AFRICA,
Dept. of Mines, Johannesburg (South Africa); and Geological Survey, Pretoria (South Africa).
C. A. Bezuidenhout, and J. F. Enslin.
In: Proceedings of the Tokyo Symposium on Land Subsidence, Vol 2, International Association of Scientific Hydrology and UNESCO, September 1969, Tokyo, p 482-495, 1970. 14 p, 8 fig, 4 plate, 10 ref.

Descriptors: *Subsidence, *Withdrawal, *Land subsidence, *Mining, Aquifers, Water levels, Water table, Water balance, Surface-groundwater relationships, Seepage, Infiltration, Compaction, Damages, Groundwater, Groundwater movement, Pumping, Soil mechanics, Rock mechanics, Water wells, Dolomites, Limestones, Gold.
Identifiers: *South Africa.

The gold-bearing reefs of the Far West Rand underlie 1,200 meters of dolomite, the most important aquifer of the Republic of South Africa. The groundwater is stored in separate dike bounded compartments (a typical one covers 160 square kilometers and has a storage capacity of 700,000 megaliters and flows into the mine workings at enormous rates, depending on the number of post-dolomite faults cutting the workings and the hydrological characteristics of those faults. The dolomitic groundwater compartments are dewatered by pumping and the disposal of the pumped water in such a way that it cannot return to the pumped compartment and recirculate through the mines. Dewatering, however, results in differtial subsidence of large areas and the formation of sinkholes; certain areas have thus become unsafe for occupation. Sinkholes form concurrently with the lowering of the water table in areas which had been free from sinkholes before. These areas fall under three groups: (1) Those where the original water table was less than 15 meters below, and less frequently within 30 meters of the surface. (2) The scarp zones bordering on the deep valleys. (3) In narrow valleys, i.e. valleys which are deeper than they are wide. Valleys which are more than 100 meters wide can still be classified as narrow valleys if they narrow down at great depth to a width which permits blockage and bridging of the unconsolidated material to occur. The bridge will be weakened and may collapse when dewatering takes place. A gravity method of delineating areas of potential subsidence and zones where the conditions are favorable for the formation of sinkholes id described. (See also W71-03148) (Knapp-USGS)
W71-03167

DAMAGE TO IRRIGATION POND DUE TO MINING SUBSIDENCE,
Kyushu Univ., Fukuoka City (Japan). Research Inst. of Science and Industry.
T. Nishida, and K. Goto.
In: Proceedings of the Tokyo Symposium on Land Subsidence, Vol 2, International Association of Scientific Hydrology and UNESCO, September 1969, Tokyo, p 496-501, 1970. 6 p, 3 fig, 3 tab, 1 ref.

Descriptors: *Subsidence, *Withdrawal, *Land subsidence, *Mining, Aquifers, Water levels, Water table, Water balance, Surface-groundwater relationships, Seepage, Infiltration, Compaction, Damages, Groundwater, Groundwater movement, Pumping, Soil mechanics, Rock mechanics, Water wells.
Identifiers: *Japan.

The irrigation ponds located in the Kyushu coal fields have been damaged due to mining subsidence. The time, point and magnitude of damage, the length of dam, and the geology were compared with the results of the theoretical calculation of the surface strains. The position of the dam within tension zones in both the directions of dam axis and flow axis affects the amount of mining damage to the pond. Increasing the magnitude of tensile strain on the dam by more than 2 mm/m a year causes leakage or exhaustion of pond water. The magnitude of damage to a dam is small in the case where the position of the dam is within the compression zones in both the direction of dam axis and of flow axis, if compressive strain is larger than 3.5 mm/m. A thick clay layer in the pond bottom prevents leakage of pond water. If a fault exists near the surface, there is a greater possibility of a crack appearing than in an undisturbed area. (See also W71-03148) (Knapp-USGS)
W71-03168

ON THE COMPRESSION SUBSIDENCE OF PEAT AND HUMIC LAYERS IN THE KAMI-SHINBASHI AREA, KURATE-MACHI, KURATE-GUN, FUKUOKA PREFECTURE,
Kyushu Univ., Fukuoka (Japan). Dept. of Engineering.
T. Noguchi, R. Takahashi, and Y. Tokumitsu.
In: Proceedings of the Tokyo Symposiun on Land Subsidence, Vol 2, International Association of Scientific Hydrology and UNESCO, September 1969, Tokyo, p 458-466, 1970. 9 p, 4 fig, 2 tab.

Descriptors: *Subsidence, *Withdrawal, *Land subsidence, Aquifers, Water levels, Water table, Water balance, Surface-groundwater relationships, Seepage, Infiltration, Compaction, Damages, Groundwater, Groundwater movement, Mining, Pumping, Soil mechanics, Rock mechanics, Water wells.
Identifiers: *Japan.

In the alluvial plain along the Onga River, Japan, in the Chikuho Coal Field, there are extensive Peat layers which cause serious cases of mining damage as they invite subsidence due to consolidation through dehydration from digging coal. In this district there are distributed widely peat layers of some ten meter thickness and soft clay beds of various thickness. As quite a long time is required for those layers to be consolidated completely, the surface, once restored, subsided again under the load of banked soil, and where the thickness of soft clay changes rapidly, there has occurred irregular subsidence accompanied by inclination of the ground surface. (See also W71-03148) (Knapp-USGS)
W71-03169

SMALL SINKING HOLES IN LIMESTONE AREA WITH SPECIAL REFERENCE TO DRAINAGE OF COAL MINES,
Kyushu Univ., Fukuoka (Japan). Dept. of Engineering.
T. Noguchi, R. Takahashi, and Y. Tokumitsu.
In: Proceedings of the Tokyo Symposium on Land Subsidence, Vol 2, International Association of Scientific Hydrology and UNESCO, September 1969, Tokyo, p 467-474, 1970. 8 p, 5 fig, 2 tab, 2 ref.

Descriptors: *Subsidence, *Withdrawal, *Land subsidence, *Sinks, *Karst, Aquifers, Water levels, Water table, Water balance, Surface-groundwater relationships, Seepage, Infiltration, Compaction, Damages, Groundwater, Groundwater movement, Mining, Pumping, Soil mechanics, Rock mechanics, Water wells, Irrigation water.
Identifiers: *Japan.

Sinkholes develop because of mine drainage in the south-eastern end of the Tagawa section of the Chikuho coal field, Japan. The strata in this neighborhood involve the Quaternary, the Tertiary and the Paleozoic. Land subsidence is traced in numerous occurrences of small sinkholes of about 4-10 m in diameter. The site where sinkholes have occurred is composed of limestone which is directly covered with the Quaternary. The Tertiary, which is distributed in the south-eastern part of the area, bears coal seams and was once worked by several collieries. Sinkholes are distributed mainly in the concave part of groundwater surface. Numerous cracks, dolina and caves lie concealed in the surrounding linestone. Sinkholes in the area were caused by the change of water level and velocity of groundwater which is flowing through caves and cracks in limestone. Similar phenomena were confirmed by model experiment. The cause of the change of groundwater can be traced back to the pumping of water at collieries in the south-eastern area, but the change still goes on even after those collieries were closed, owing to pumping from wells drilled for irrigation purposes. (See also W71-03148) (Knapp-USGS)
W71-03170

CONSOLIDATION PHENOMENON CAUSED BY MINE DRAINAGE IN THE AREA OUTLYING FROM WORKING PLACE,
Kyushu Univ., Fukuoka (Japan). Dept. of Engineering.
T. Noguchi, R. Takahashi, and Y. Tokumitsu.
In: Proceedings of the Tokyo Symposium on Land Subsidence, Vol 2, International Association of Scientific Hydrology and UNESCO, September 1969, Tokyo, p 475-482, 1970. 8 p, 6 fig, 1 tab.

Descriptors: *Subsidence, *Withdrawal, *Land subsidence, *Mining, Aquifers, Water levels, Water table, Water balance, Surface-groundwater relationships, Seepage, Infiltration, Compaction, Damages, Groundwater, Groundwater movement, Pumping, Soil mechanics, Rock mechanics, Water wells, Water quality, Faults (Geology), Fractures (Geology).
Identifiers: *Japan.

In the Kishima collieries, Japan, coal is mined underground and the surface has subsided in places so

detached from the working area that it is impossible to explain by the usual hydrological relations. The Omachi fault (throw 300 m, inclining southward) runs from east to west, and surface subsidence is concentrated along this fault line. The alluvium is composed of clay and gravel beds. Its thickness is 40-50 m on the north of the fault and 350-400 m on the south side. The main cause of subsidence on the north side of the Omachi fault is in the consolidation of the first clay bed, but on the south side the subsidence is in the consolidation of the third clay bed. In this area there are several faults running from north to south, through which the Omachi fault is connected hydraulically with the underground working of the Kishima coal mine. This fact has been proved by the chloride ion test of underground water near and around the Omachi fault. (See also W71-03148) (Knapp-USGS)
W71-03171

MODEL STUDIES OF DIFFERENTIAL COMPACTION,
Georgia Univ., Athens.
Robert E. Carver.
In: Proceedings of the Tokyo Symposium on Land Subsidence, Vol 2, International Association of Scientific Hydrology and UNESCO, September 1969, Tokyo, p 450-458, 1970. 9 p, 5 fig, 22 ref.

Descriptors: *Subsidence, *Withdrawal, *Land subsidence, *Model studies, Hydraulic models, Aquifers, Water levels, Water table, Water balance, Surface-groundwater relationships, Seepage, Infiltration, Compaction, Damages, Groundwater, Groundwater movement, Mining, Pumping, Soil mechanics, Rock mechanics, Water wells, Hydrogeology, Faults (Geology), Fractures (Geology).
Identifiers: *Differential compaction.

Phenomena associated with differential compaction of sediments can be reproduced in models employing liquid-solid suspensions subjected to differential vacuum. Suspensions of clay-sized particles which approximate the porosity of young sediments are easily prepared and have viscosities and shear strengths much lower than other, commonly used, fracturable materials. Both field observation and experiment indicate the response to differential compaction is, in many cases, differential subsidence coupled with fracture. Fracture effects vary in scale of displacement from thousands of meters, in regional contemporaneous faults that parallel the coast of Texas, U.S.A. to decimeters in fractures caused by recent withdrawal of groundwater and petroleum in Texas and Arizona. Model studies indicate that a differentially compacting sediment mass fails in shear in a manner analogous to the failure of a simply supported beam. Therefore, fracture of the sediment mass should be predictable, in time and space, if sufficient information about physical properties of the sediment mass is available. (See also W71-03148) (Knapp-USGS)
W71-03172

MODEL EXPERIMENTS ON LAND SUBSIDENCE,
Kyoto Univ. (Japan). Disasters Prevention Research Inst.
S. Murayama.
In: Proceedings of the Tokyo Symposium on Land Subsidence, Vol 2, International Association of Scientific Hydrology and UNESCO, September 1969, Tokyo, p 431-449, 1970. 19 p, 28 fig, 5 ref.

Descriptors: *Subsidence, *Withdrawal, *Land subsidence, *Model studies, *Hydraulic models, Aquifers, Water levels, Water table, Water balance, Surface-groundwater relationships, Seepage, Infiltration, Compaction, Damages, Groundwater, Groundwater movement, Mining, Pumping, Soil mechanics, Rock mechanics, Water wells.
Identifiers: *Japan.

In order to investigate the characteristic relations between land subsidence and withdrawal of groundwater in the aquifer, some model experiments on a large scale were performed. Model soil layers were set in a water filled tank. The tanks used were a reinforced concrete tank of a rectangular form of 5 m X 2.7 m, 2.3 m in height, and 2 steel cylindrical tanks, each 2 m in diameter and 1.5 m high. One series of tests was performed on a clay layer placed on a sand aquifer. In the other series of tests, 2 clay layers and 2 sand layers were alternately filled in the steel tank. On the top surface of the soil layers was free surface water. Land movements due to lowering and recovering of the artesian head, land subsidence due to the change in the artesian head, and effects of change in the level of the surface water on the land subsidence and on the artesian head were studied in the models. Under varying artesian head, clay layers and sand aquifer showed subsidence due to compacting. The amount of subsidence caused in the sand layer depends on its initial density and the number of repetitions of the artesian head. (See also W71-03148) (Knapp-USGS)
W71-03173

ANALYSIS OF BOREHOLE EXTENSOMETER DATA FROM CENTRAL CALIFORNIA,
Geological Survey, Sacramento, Calif.
Francis S. Riley.
In: Proceedings of the Tokyo Symposium on Land Subsidence, Vol 2, International Association of Scientific Hydrology and UNESCO, September 1969, Tokyo, p 423-431, 1970. 9 p, 1 fig, 4 ref.

Descriptors: *Subsidence, *Withdrawal, *Land subsidence, *California, *Borehole geophysics, Aquifers, Water levels, Water table, Water balance, Surface-groundwater relationships, Seepage, Infiltration, Compaction, Damages, Groundwater, Groundwater movement, Pumping, Soil mechanics, Rock mechanics, Water wells.
Identifiers: *Borehole extensometers.

In subsiding areas of central California, highly sensitive borehole extensometers provide data that define the compression characteristics of the compacting artesian aquifer systems. The extensometer records are combined with hydrographs for the confined and unconfined aquifers to form stress-strain diagrams on which the annual cycles of head decline and recovery generate a series of open loops. Grass compaction, elastic expansion, and net permanent compaction are clearly defined. The average level of preconsolidation stress, the elastic compressibility at lesser stresses, and the much larger plastic compressibility at higher stresses can often be determined from such diagrams. At a given location, these compressibilities may differ by as much as two orders of magnitude. Under favorable circumstances, estimates of the average vertical permeability and average compressibility of the fine-grained strata can be derived. (See also W71-03148) (Knapp-USGS)
W71-03174

THE MECHANICS OF COMPACTION AND REBOUND, WILMINGTON OIL FIELD, LONG BEACH, CALIFORNIA, U.S.A.
Long Beach Dept. of Oil Properties, Calif.
D. R. Allen, and M. N. Mayuga.
In: Proceedings of the Tokyo Symposium on Land Subsidence, Vol 2, International Association of Scientific Hydrology and UNESCO, September 1969, Tokyo, p 410-423, 1970. 14 p, 14 fig, 18 ref.

Descriptors: *Subsidence, *Withdrawal, *Land subsidence, *Oil fields, California, Compaction, Damages, Groundwater, Groundwater movement, Mining, Pumping, Soil mechanics, Rock mechanics, Oil wells, Injection wells.
Identifiers: *Wilmington Oil Field (Calif).

The ground surface above the center of oil production in the Wilmington Oil Field, California, subsided about 9 meters over 27 years. Subsidence was related to compaction in the oil reservoirs caused by fluid production and pore pressure reduction. Axial loading tests on the reservoir sands and shales show the sands to be as compactable as the shales. Reservoir calculations, oil well casing measurements, and laboratory tests indicated a reduction as great as 3 to 4% in the bulk sand volumes (about 10-11% of the pore volume). It is concluded that most of the compaction prior to 1952 occurred in the reservoir sands. Calculations show 32.4% of the cumulative compaction in the shales and 67.6% in the sands. Water injection programs arrested subsidence and caused elastic rebound, which in conjunction with pump pressures has uplifted the surface as much as 33.5 cm over 8 years. Rebound is believed to be confined principally to the sand intervals. The coefficient of rebound is estimated to be .005 of vertical sand thickness; of which only about 50% is seen at the surface due to unrelieved stresses in the overburden. (See also W71-03148) (Knapp-USGS)
W71-03175

OBSERVATION OF COMPACTION OF FORMATION IN THE LAND SUBSIDENCE OF NIIGATA CITY,
Industrial Science and Technology Agency, Kawasaki (Japan). Geological Survey.
Shun-ichi Sano.
In: Proceedings of the Tokyo Symposium on Land Subsidence, Vol 2, International Association of Scientific Hydrology and UNESCO, September 1969, Tokyo, p 401-409, 1970. 9 p, 5 fig, 4 ref.

Descriptors: *Subsidence, *Withdrawal, *Land subsidence, *Radioactivity techniques, Aquifers, Water levels, Water table, Water balance, Surface-groundwater relationships, Seepage, Infiltration, Compaction, Damages, Groundwater, Groundwater movement, Pumping, Soil mechanics, Rock mechanics, Water wells.
Identifiers: *Niigata (Japan).

A method for measuring vertical distribution of compaction of a formation was developed by utilizing radioisotopes. Radiation sources made of cobalt 60 were shot into formations by a gun-perforator in a well at various depths. The sources were measured by a specially designed gamma-ray logger at intervals of about a year. Compaction during the period between two successive measurements was derived from difference of the distances. The two radioisotope observation wells were sunk at Niigata, Japan which has suffered remarkable subsidence since around 1956, and the observation at these wells was carried out since 1961. The observational results could be compared with drainage of groundwater and injection to aquifers. (See also W71-03148) (Knapp-USGS)
W71-03176

FINITE ELEMENT ANALYSIS OF LAND SUBSIDENCE,
Ohio State Univ., Columbus. Dept. of Civil Engineering; and California Univ., Berkeley. Dept. of Civil Engineering.
Ranbir S. Sandhu, and Edward L. Wilson.
In: Proceedings of the Tokyo Symposium on Land Subsidence, Vol 2, International Association of Scientific Hydrology and UNESCO, September 1969, Tokyo, p 393-400, 1970. 8 p, 4 fig, 20 ref.

Descriptors: *Subsidence, *Withdrawal, *Land subsidence, *Numerical analysis, Computer programs, Aquifers, Water levels, Water table, Water balance, Surface-groundwater relationships, Seepage, Infiltration, Compaction, Damages, Groundwater, Groundwater movement, Mining, Pumping, Soil mechanics, Rock mechanics, Water wells.
Identifiers: *Finite element analysis.

The finite element method was applied to the problem of land subsidence. The settlement of a land mass is viewed as an immediate or time dependent surface deformation caused by direct application of surface loads or by the loss of support associated with mining or withdrawal of pore fluids. Practically all cases involving static or quasi-static subsidence can be treated. The method permits

consideration of complex geometrical configurations and arbitrary boundary conditions. Nonhomogeneity, anisotropy, viscoelasticity and creep, temperature effects, residual stresses, and plastic behavior can be allowed for. The method is applicable to two or three dimensional deformation and thus takes into account horizontal as well as vertical movements. (See also W71-03148) (Knapp-USGS)
W71-03177

SAND COMPRESSION AS A FACTOR IN OIL FIELD SUBSIDENCE,
San Jose State Coll., Calif. Dept. of Civil Engineering.
James E. Roberts.
In: Proceedings of the Tokyo Symposium on Land Subsidence, Vol 2, International Association of Scientific Hydrology and UNESCO, September 1969, Tokyo, p 368-376, 1970. 9 p, 5 fig, 1 tab, 8 ref.

Descriptors: *Subsidence, *Withdrawal, *Land subsidence, *Oil fields, *Sands, Clays, Compaction, Damages, Groundwater, Groundwater movement, Pumping, Soil mechanics, Rock mechanics, Water wells.
Identifiers: *Venezuela.

The results of a comprehensive experimental investigation of the compressibility of clastic sediments at high pressures are summarized. In the pressure range of 1,000 to 20,000 psi, some sands are at least as compressible as typical clays. This high compressibility, which is due to a shattering of individual grains, indicates that a stratum of oil-bearing sand which is subjected to effective stress changes may contribute significantly to surface subsidence. The relative importance of clay and sand compression as contributory to subsidence and the conditions under which either or both is important are summarized. It is concluded that even at a depth of 3000 feet compression of oil-bearing sands may contribute significantly to subsidence. (See also W71-03148) (Knapp-USGS)
W71-03178

COMPRESSIBILITIES OF CLAYS AND SOME MEANS OF PREDICTING AND PREVENTING SUBSIDENCE,
University of Southern California, Los Angeles. Dept. of Petroleum Engineering.
George V. Chilingar, Herman H. Rieke, III, and Costandi Sawabini.
In: Proceedings of the Tokyo Symposium on Land Subsidence, Vol 2, International Association of Scientific Hydrology and UNESCO, September 1969, Tokyo, p 377-393, 1970. 17 p, 6 fig, 2 tab, 56 ref.

Descriptors: *Subsidence, *Withdrawal, *Land subsidence, *Soil stabilization, Aquifers, Water levels, Water table, Water balance, Surface-groundwater relationships, Seepage, Infiltration, Compaction, Damages, Groundwater, Groundwater movement, Pumping, Soil mechanics, Rock mechanics, Water wells, Water chemistry, Electro-osmosis, Clay minerals.
Identifiers: Soil compressibility.

The compressibilities of halloysite, dickite, illite, kaolinite, hectorite, montmorillonite, attapulgite, and soil samples were determined and compared with those determined with the samples saturated with fresh water or sea water. Compressibility ranges from 0.0000 867 to 0.000 294 per psi at 1000 psi and from 0.00000 162 to 0.00000 716 per psi at 100,000 psi. Salinity of the squeezed-out solutions changes with pressure and the mineralization of interstitial waters in shales should be lower than that in associated sandstones, if water moves from shale into sand. Thus, the salinity of interstitial solutions may give a clue as to the degree of subsequent compaction. In addition, decreasing salinity of produced waters with time may indicate water influx into sands from the associated undercompacted shales. A new technique of electrochemical stabilization of undercompacted formations is offered as a possible solution to the subsidence problem. Electrochemical stabilization involves application of direct electric current in conjunction with introducing various electrolytes, such as calcium chloride, aluminum acetate, and aluminum sulfate. (See also W71-03148) (Knapp-USGS)
W71-03179

SOIL-WATER DISEQUILIBRIUM AS A CAUSE OF SUBSIDENCE IN NATURAL SOILS AND EARTH EMBANKMENTS,
Commonwealth Scientific and Industrial Research Organization, Melbourne (Australia). Div. of Soil Mechanics.
O. G. Ingles, and G. D. Aitchison.
In: Proceedings of the Tokyo Symposium on Land Subsidence, Vol 2, International Association of Scientific Hydrology and UNESCO, September 1969, Tokyo, p 342-353, 1970. 12 p, 5 fig, 32 ref.

Descriptors: *Subsidence, *Withdrawal, *Land subsidence, *Tunnels, *Erosion, Aquifers, Water levels, Water table, Water balance, Surface-groundwater relationships, Seepage, Infiltration, Compaction, Damages, Groundwater, Groundwater movement, Soil mechanics, Rock mechanics, Water wells, Soil erosion.

The widespread occurrence of localized soil subsidences following sub-surface tunnelling by erosion, both in natural soils and in earth embankments, is explained in terms of a metastable state involving chemical, hydrological and mechanical factors. The sources of excessive voids which precondition the soil for such failures and the conditions under which water flow into these voids adversely affect the safety of the soil structure are described. The hazards are most acute when the soil itself is capable of spontaneous dispersion and loss of cohesion in contact with water whose chemical composition is not in equilibrium with the soil. Appropriate procedures for evaluation of the risk of such tunnelling subsidences and available remedial measures are given. (See also W71-03148) (Knapp-USGS)
W71-03180

STUDIES ON PARTIAL COMPACTION OF SOIL LAYER IN REFERENCE TO LAND SUBSIDENCE IN TOKYO,
Tokyo Inst. of Civil Engineering (Japan); and Komazawa Univ., Tokyo (Japan).
Shigeru Aoki, and Naomi Miyabe.
In: Proceedings of the Tokyo Symposium on Land Subsidence, Vol 2, International Association of Scientific Hydrology and UNESCO, September 1969, Tokyo, p 354-360, 1970. 7 p, 3 fig, 1 tab, 3 ref.

Descriptors: *Subsidence, *Withdrawal, *Land subsidence, Aquifers, Water levels, Water table, Water balance, Surface-groundwater relationships, Seepage, Infiltration, Compaction, Damages, Groundwater, Groundwater movement, Pumping, Soil mechanics, Rock mechanics, Water wells, Hydrogeology.
Identifiers: *Tokyo (Japan).

Apparent land subsidence as recorded by compaction recorders is measured in the soil layer between the ground surface and the level where the reference tube of the compaction recorder is fixed. This part of the soil layer is composed of two or more layers which have different mechanical properties. Assuming that the compaction of each soil layer is proportional to the layer's effective thickness, its distance from the groundwater level, and the change in the height of the groundwater level, the compaction recorder response is analyzed into responses caused by the separate layers. (See also W71-03148) (Knapp-USGS)
W71-03181

SHORT-TERM MOVEMENT OF THE LAND SURFACE NEAR WATER WELLS,
Hawaii Univ., Honolulu. Dept. of Geosciences.
Frank L. Peterson, and Stanley N. Davis.
In: Proceedings of the Tokyo Symposium on Land Subsidence, Vol 2, International Association of Scientific Hydrology and UNESCO, September 1969, Tokyo, p 360-367, 1970. 8 p, 5 fig, 11 ref.

Descriptors: *Subsidence, *Withdrawal, *Land subsidence, Aquifers, Water levels, Water table, Water balance, Surface-groundwater relationships, Seepage, Infiltration, Compaction, Damages, Groundwater, Groundwater movement, Pumping, Soil mechanics, Rock mechanics, Water wells, Injection wells, California.
Identifiers: *Santa Clara Valley (Calif).

Stresses related to short-term pumping (or injecting) water from wells result in measurable movements of the land surface. Sensitive transducers coupled to horizontal and vertical extensometers enable relative movements to be measured with a precision of 0.1 micron. The testing periods were limited to about one hour or less owing primarily to strain buildup in the extensometers. Total vertical movement probably ranged between 1 and 100 microns on most of 196 tests on 19 wells, and horizontal movement was as great as 15 microns per meter of lateral distance. With only one exception, short-term effects were almost perfectly elastic. Pumping and injecting equal amounts of water produced movements of similar magnitude but in opposite directions. During pumping, the shape at the surface depression resembled the surface deflection produced by a concentrated load on an elastic plate of infinite extent. (See also W71-03148) (Knapp-USGS)
W71-03182

2G. Water in Soils

SOIL SURFACE CHARACTERISTICS AND RAINFALL-RUNOFF-MOISTURE RELATIONSHIPS ON COASTAL PLAIN SOILS,
Auburn Univ., Ala. Water Resources Research Inst.
Ronald E. Hermanson.
Available from NTIS as PB-196 307, $3.00 in paper copy, $0.95 in microfiche. Auburn University Water Resources Research Institute Bulletin 702, June 1970. 77 p, 21 fig, 5 tab, 74 ref, append. OWRR Project A-005-ALA (1).

Descriptors: *Rainfall-runoff relationships, *Infiltration, *Antecedent precipitation, Soil water movement, Runoff forecasting, Alabama, Soil physical properties, Sands, Clays, Hydraulic conductivity, Vegetation effects, Hydraulic models.
Identifiers: Experimental watersheds.

The hydraulic conductivities of a sandy soil and a sandy clay loam were related to bulk density. Bulk density of the soil was predicted from moisture content and the resistance of the soil as measured by a cone penetrometer. The effects on infiltration of both the soil geometry and the surface cover were determined. An H-flume and Cashocton wheel system for measuring and sampling runoff was modified to minimize sediment deposition in the system. Eight runoff plots were instrumented at a research farm in the Coastal Plain of Alabama. A digital data acquisition system was developed to record runoff, rainfall and other weather data on computer compatible magnetic tape. (Knapp-USGS)
W71-02751

EVALUATION OF EARTHLY MATERIALS FOR USE IN DECONTAMINATION OF WATER,
Auburn Univ., Ala. Water Resources Research Inst.
For primary bibliographic entry see Field 05B.
W71-02752

ENDRIN, DIELDRIN AND ALDRIN ADSORPTION AND DECOMPOSITION BY CLAY MINERALS AND SOIL CLAYS,
Auburn Univ., Ala. Dept. of Agronomy and Soils.
For primary bibliographic entry see Field 05B.
W71-02753

SORPTION OF AMIBEN AND THE METHYL ESTER OF AMIBEN BY CLAY MINERALS AND SOILS,
Auburn Univ., Ala. Dept. of Agronomy and Soils.
For primary bibliographic entry see Field 05B.
W71-02755

GLYCEROL VAPOR ADSORPTION ON CLAY MINERALS AND MONTMORILLONITIC SOIL CLAYS,
Auburn Univ., Ala. Dept. of Agronomy and Soils.
For primary bibliographic entry see Field 05B.
W71-02756

MOVEMENT OF SALTS IN PONDED ANISOTROPIC SOILS,
California Univ., Davis. Dept. of Water Science and Engineering.
Jaime Ortiz, and James N. Luthin.
ASCE Proceedings, Journal of the Irrigation and Drainage Division, Vol 96, No IR3, Paper 7530, p 257-264, September 1970. 8 p, 5 fig, 6 ref, append.

Descriptors: *Leaching, *Saline soils, *Saline water-freshwater interfaces, *Tile drainage, Soil water movement, Groundwater movement, Ion transport, Mass transfer, Drainage engineering, Subsurface drainage, Tile drains, Computer programs.
Identifiers: *Ponded anisotropic soils.

A method of determining the displacement front of an interface between saline and fresh water to subsurface drains under ponded conditions is extended to anisotropic soils. A computer program written in FORTRAN IV allows determination of the position of the displacement front at different times when point values of the stream and potential function are available. The results presented can be applied to any other system geometrically similar to the system considered. Leaching in the region halfway between drains will be better for an anisotropic soil than for an isotropic one. (Knapp-USGS)
W71-02757

PROBLEMS OF EVALUATION OF SOIL MOISTURE FOR WATER BALANCES ON LARGE AREAS,
Technical Univ. of Prague (Czechoslovakia). Soil Science Lab.
Miroslav Kutilek.
In: Symposium on World Water Balance, Vol 1, International Association of Scientific Hydrology Publication No 92, p 129-136, July 1970. 8 p, 1 tab, 5 ref.

Descriptors: *Water balance, *Soil moisture, *Gaging stations, *Network design, Systems analysis, Soil moisture meters, Surveys, Hydrogeology, Water storage, Soil water movement, Hydrologic budget, Data collections, Hydrologic data.
Identifiers: Soil water balance.

The basic criteria for the location of soil moisture observation stations were determined by using systems analysis methods. The stations ought to be located on representative soil districts, considering the dominant types of vegetation, landscape forms and hydrogeological conditions. To extrapolate the measurements beyond the boundary of districts of uniform soil, vegetation, topographic and hydrogeological conditions, functional relationships must be found. A general procedure for the evaluation of the soil moisture data is suggested. In the proposal for soil moisture classification, the following aspects were considered: (1) Quantity of stored water in the profile with regard to the moisture content ranges, (2) duration of these moisture content ranges, (3) moisture stratification. (Knapp-USGS)
W71-02766

THE IMPORTANCE OF RAINFALL AND SOIL MOISTURE IN THE AGRICULTURAL DEVELOPMENT OF THE CLOSED FOREST ZONE OF GHANA,
For primary bibliographic entry see Field 03F.
W71-02794

KHAIRPUR TUBEWELL PROJECT,
West Pakistan Water and Power Development Authority, Lahore.
R. F. Stoner.
In: Proceedings of Central Treaty Organization Seminar on Evaluation of Water Resources With Scarce Data, March 4-8, 1969, Tehran, Iran, p 223-246, January 1970. 24 p, 11 fig, 2 tab, 6 ref.

Descriptors: *Water resources, *Water resources development, *Saturated soils, *Subsurface drainage, *Foreign projects, Controlled drainage, Irrigation, Irrigation systems, Runoff, Groundwater, Aquifers, Hydrologic data, Water quality, Salinity, Wells, Water table, Crops, Crop productions, Water quality control.
Identifiers: *West Pakistan, Tubewells.

This water-resources development project covers an irrigable area of 353,000 acres in West Pakistan. The main purpose of the project, as originally defined, was to provide for drainage and reclamation of waterlogged and saline land. As the planning concepts changed with further study the purpose gradually broadened until the main objective of the project became to ensure the best possible use of land and water resources. This objective was to be achieved by lowering the water-table to a level which would not prejudice crop growth; by reducing the soil salinity within the root zone where necessary to promote healthy plant growth; by supplying additional water to raise the cropping intensity from the original level of 90 percent to 135 percent or to even higher intensities if these ultimately prove to be possible and economic. Maps, tables, graphs, and text material are presented in relating plans, methods, and results of the project. Rigid salinity standards were adopted: direct reuse of pumped water was recommended up to a salinity of 1000 ppm; between 1000 and 2,500 ppm groundwater could be used only if mixed with surface water in various proportions; beyond a salinity of 2,500 ppm the groundwater was to be discharged into the drainage system. The design of wells follows the Thiem and Theis equations. An immediate response has occurred to the use of fresh water and subsoil drainage in improved crops and expanded acreage cropped. (Woodard-USGS)
W71-02816

VEGETATION ARCS IN JORDAN,
Hunting Technical Services Ltd., Boreham Wood (England).
L. P. White.
Journal of Ecology, Vol 57, No 2, p 461-464, 1969. 2 fig, 1 tab, 8 ref.

Descriptors: *Sheet flow, *Arid lands, *Hydrogeology, *Vegetation, Xerophytes, Halophytes, Shrubs, Hydrologic aspects, On-site investigations, Mode of action, Environmental effects, Check structures, Leaching, Deserts, Watersheds (Basins), Alluvium, Alkaline soils, Soil chemistry, Plant populations, Saline soils.
Identifiers: *Jordan, *Hummocks, *Vegetation arcs, *Wadis, *Range classification.

Vegetation arcs on otherwise bare alluvial flats were recorded and described from the northern Jordan desert. The valley floor and parts of the basin floor were occupied by saline silted bare flats (Qas). The slopes are low and periodic inundation occurs. The vegetation arcs of the Qas are oriented at right angles to the direction of sheet-flow. Principal components of the arc vegetation are low xerophytic and halophytic shrubs in small groups on wind-blown hummocks. The arcs appear to be a primary colonization and their contiguous hummocks act as check dams to sheet-wash. (Casey-Arizona)
W71-02858

FORAGE POTENTIAL OF IRRIGATED BLUE GRAMA WITH NITROGEN FERTILIZATION,
Southwestern Great Plains Research Center, Bushland, Tex.
O. R. Lehman, J. J. Bond, and H. V. Eck.
Journal of Range Management, Vol 21, No 2, p 71-73, March 1968. 3 tab, 11 ref.

Descriptors: *Grama grasses, *Forage grasses, *Nitrogen, *Water utilization, *Fertilization, Great Plains, Fertilizers, Irrigation effects, Efficiencies, On-site investigations, Range management, Texas, Crop response, Crop production, Proteins, Rates of application, Soil-water-plant relationships, Nutrient requirements.
Identifiers: *Water use efficiency.

Blue grama (Bouteloua gracilis H. B. K.) does not respond to irrigation with increased yields. On irrigated check plots, annual forage production was 1/2-1/4 tons/acre. As N applications were increased from 200-800 lb./acre, blue grama yields and associated protein contents increased. Only the 800 lb./acre treatment resulted in significant yield and protein content increases beyond 1 year. Added N recovery was very low. On the 800 lb. application, recoveries were 53% and 39% in the first and second years, respectively. Water-use efficiencies were greatly increased after N addition. The 800 lb. application increased water use efficiency about 5 times in 2 successive years. Without added N, water use efficiencies were not increased. Apparently, blue grama is a relatively inefficient utilizer on both N and water compared to several other forage grasses. (Casey-Arizona)
W71-02861

SORGHUM FOLIAR RESPONSES TO CHANGES IN SOIL WATER CONTENT,
Agricultural Research Service, Phoenix, Ariz. Water Conservation Lab.
For primary bibliographic entry see Field 02D.
W71-02865

INFLUENCE OF MINERALS ON SR90 AND CS137 UPTAKE BY BEAN PLANTS,
California Univ., Los Angeles. Lab. of Nuclear Medicine and Radiation Biology.
For primary bibliographic entry see Field 05C.
W71-02867

ALFALFA FOR FORAGE PRODUCTION IN ARIZONA,
Arizona Agricultural Experiment Station, Tucson.
R. E. Dennis, K. C. Hamilton, M. A. Massengale, M. H. Schonhorst, and L. J. Erie.
University of Arizona, Cooperative Extension Service and Agricultural Experimental Station, Bulletin A-16, revised July 1966. 40 p, 38 fig, 1 tab.

Descriptors: *Alfalfa, *Forages, *Crop production, *Irrigation, *Arizona, Mites, Water quality, Temperature, Soil-water-plant relationships, Weed control, Nematodes, Fertilization, Arid lands, Moisture availability, Border irrigation, Consumptive use, Flood irrigation, Harvesting, Irrigated land, Insects, Irrigation ditches, Plant diseases, Seeds, Sprinkler irrigation, Preservation, Varieties, Water requirements, Selectivity, Planting management, Hay, Pest control, Fertilizers, Timing, Application methods.
Identifiers: *Crop requirement, *Growing season, Crop adaptation, Corrugation, Inoculation, Irrigation basins, Egyptian alfalfa weevil, Stand establishment.

Alfalfa, the most important forage crop under irrigation in Arizona, is adapted to many climates and soils. It accounts for 20 percent of the total irrigated cropland, and is grown from near sea level elevations at Yuma to over 5,000 feet. About 85 percent of the acreage is located in arid southern

Arizona. Factors accounting for the 4 to 12 tons per acre production include length of growing season, variety, irrigation, management, temperature, water quality and soil fertility. Major sections of this report discuss the alfalfa plant, varieties, seed selections, land selection and preparation, irrigation, fertilization, inoculation (seeding and stand establishment), management, harvesting and preserving methods, weed control, harmful insects and mites, Egyptian alfalfa weevil, alfalfa diseases and nematodes. Alfalfa, because of its rapid growth, length of growing season and large greenery produced, has a high water requirement and needs adequate moisture. Water may be applied by the common border method, corrugations, border ridges, sprinkling and flooding from contour field ditches and of basins. Border width, moisture requirements, irrigation fertilization, and irrigation practices are discussed in terms of crop management. Figures show alfalfa varieties at various stages, diseased species, plant pests, operational harvesting and seeding, consumptive water use, and alfalfa adaption areas. (Popkin-Arizona)
W71-02868

ELECTRICAL EFFECTS AND THE MOVEMENT OF WATER IN SOILS,
Purdue Univ., Lafayette, Ind. Water Resources Research Center.
D. Swartzendruber, and S. Gairon.
Available from NTIS as PB-196 314, $3.00 in paper copy, $0.95 in microfiche. Purdue University Water Resources Research Center Technical Report No 13, July 1970. 40 p, 16 fig, 2 tab, 19 ref. OWRR Project B-005-IND (1).

Descriptors: *Soil water movement, *Infiltration, Saturated flow, Electrodes, *Hydraulic gradient, Kaolinite, Clays, Montmorillionite.
Identifiers: Electrical potential, Streaming potential.

The study deals with electrical streaming potential effects on water movement in the soil. For saturated conditions, the only response was the step change in electrical potential at initiation or cessation of hydraulic flow. The direction and magnitude of this 'E step' were consistent with those of the streaming potential phenomenon. The magnitude of the 'E step' was essentially proportional to the hydraulic gradient. For unsaturated flow, electrical potentials measured during upward entry of water into columns of initially air-dry sand kaolinite showed that as the wet front moved past an electrode, characteristic negative peaks were observed. Electrical potential, water flux, and hydraulic gradient were also studied for saturated water flow through plugs of sodium bentonite at concentrations ranging from 11.5 to 35.1% clay. At the lowest clay content, the relationship between electrical potential and hydraulic gradient, and between water flux and hydraulic gradient were both less than proportional, while at 28.4% clay both relationships were strictly proportional and at 35.1% clay the relationship was more than proportional. Even in this latter case, the relationship was linear, displaced from the origin to yield a positive gradient intercept. (Wiersma-Purdue)
W71-02877

A SOIL WATER MODEL FOR TWO CONTRASTING TILLAGE SYSTEMS,
Virginia Polytechnic Inst., Blacksburg. Water Resources Research Center.
V. O. Shanholtz, and J. H. Lillard.
Available at NTIS as PB-196 364, $3.00 in paper copy, $0.95 in microfiche. Virginia Polytechnic Institute and State University, Water Resources Research Center Bulletin 38, October 1970. 217 p, 48 fig, 11 tab, 74 ref, 10 append. OWRR Project A-018-VA (3).

Descriptors: *Evapotranspiration, *Water balance, *Consumptive use, *Corn (Field), *Mathematical models, Computer programs, Simulation analysis, Hydrologic budget, Rainfall, Evaporation, Soil water, Soil moisture.
Identifiers: *Soil water budget.

Techniques were developed to simulate the soil-plant environment as a semi-dynamic hydrologic system. Exponential expressions give reasonable estimates of soil evaporation prior to corn plant emergence. A family of nonlinear curves were used to estimate evapotranspiration after emergence. These curves assumed that pan evaporation was the integrated result of atmospheric demands. Precipitation excess was estimated from an exponential expression using total water storage capacity in the Ap or A soil horizon. Corn plant heights were simulated with a 2-part nondimensional exponential relationship. Rainfall interception was assumed to be a function of rainfall, plant height, and density of cover. Vertical water movement through the soil was assumed to be related to its saturated hydraulic conductivity. All aspects of the model were programmed in the Fortran language for an IBM 360 Computer. A comparison of simulated with observed data indicates very good agreement. With few exceptions, the simulated results were well within sampling variation. (Knapp-USGS)
W71-02883

MOVEMENT OF BACTERIA FROM A RIVER TO A MUNICIPAL WELL--A CASE HISTORY,
Geological Survey, Albany, N.Y.
For primary bibliographic entry see Field 05B.
W71-02909

IRRIGATION: WHEN-HOW MUCH-HOW,
Arizona Univ., Tucson. Cooperative Extension Service.
Allan D. Halderman.
University of Arizona, Cooperative Extension Service and Agricultural Experiment Station, Bulletin A-20, Revised April 1970. 16 p, 18 fig, 3 tab, 1 ref.

Descriptors: *Surface irrigation, *Irrigation efficiency, *Water management (Applied), *Irrigation practices, *Soil management, Soil-water-plant relationships, Moisture tension, Moisture deficit, Tensiometers, Soil moisture, Soil moisture meters, Water quality, Root zone, Color, Leaching, Wilting, Growth rates, Border irrigation, Furrow irrigation, Arizona, Arid lands, Moisture availability, Depth, Soil texture, Moisture uptake, Water requirements.
Identifiers: *Irrigator's aid relationship, *Leaching requirement, *Soil-water potential, *Soil tension, Clodding, Leaf temperature, Soil probes, Basin irrigation, Corrugation irrigation.

In this bulletin guides for surface irrigation are discussed. Plant signs indicating when to irrigate include wilting, color, leaf temperature, growth rate, and development stage. Soil signs include available moisture and soil moisture tension. Anticipating moisture needs by planning ahead is emphasized. Water should be applied according to the soil moisture deficiency in the root zone. Leaching requirements for soil and moisture requirements for plants are discussed in terms of water quality and clodding potential. Use of soil probes and tensiometers are described. Water should be distributed evenly by border, furrow, basin and corrugation methods. Mentioned also are soils which absorb water slowly and rapidly. The irrigator's aid relationship is Q time t equals d times A, where Q is stream size in cubic feet per second (cfs), t is time of set in hours, d is depth of water applied in inches, and A is area irrigated in acres. Two examples are worked and conversion factors for miner's inches to cfs to gallons per minute and number of 38-inch rows to width in feet to number of 40-inch rows are given. Figures and tables give ways of establishing when, how much and how to irrigate. (Popkin-Arizona)
W71-02958

SALT CONCENTRATIONS IN SOILS FURROW-IRRIGATED WITH SALINE WATERS,
Texas Agricultural Experiment Station, College Station.
D. E. Longenecker, E. L. Thaxton, Jr., and P. J. Lyerly.
Texas A and M University, Texas Agricultural Experiment Station, MP-939, December 1969. 12 p, 2 tab, 8 fig, 7 ref.

Descriptors: *Saline water, *Furrow irrigation, *Salinity, Irrigation practices, *Soil water movement, Irrigation water, Soil-water-plant relationships, Leaching, Cotton, Calcium, Magnesium, Water management (Applied), Rainfall, Water chemistry, Texas, Arid lands, Furrows, Salts, Irrigation effects, Saline soils, Slopes, Irrigation systems, Rotations, Planting management, Spatial distribution, Crop response, Seasonal, Subsoil, Rates of application, Frequency.
Identifiers: *Salt concentrations, *Salt movement, *Salinity control, Row spacing, Cations.

This 3-year study of movement, distribution, leaching and accumulation of salt in soils yielded information about a new variable row spacing for cotton. Tests of level irrigation at El Paso and sloping irrigation at Pecos were relocated in order to study cumulative salinity effects of differential irrigation frequencies and rates under current management systems. Soil salinity increases occurred from reduced applications rates of saline water to various row spacings. Salinity increases were due to inadequate leaching. Third-year subsoil salinity was dangerously high. Soluble Ca and Mg concentrations were reversed in soils and waters at both locations. Ca was higher in waters; Mg was higher in soils. Salinity on sloping soils increased with distance from water application sources and was seriously high near lower ends of 1000-foot lengths, regardless of irrigation frequency or rate or the planting system used. Double row bed systems develop high subsoil salinity and require special care to avoid excessive accumulation. On sloping systems where irrigation waters are saline and where rainfall does not leach soil, there is no alternative to heavy water application to maintain low soil salinity. If total water application is less than adequate to control salinity, the leaching process can be intensified by rotation with other systems. Tables and figures showing water analyses, irrigation practices, row spacing salinity and cotton emergence are included in the article. (Popkin-Arizona)
W71-02961

WATER USE BY IRRIGATED SUGAR BEETS IN THE TEXAS HIGH PLAINS,
Agricultural Research Service, Bushland, Tex. Southwestern Great Plains Research Center.
A. D. Schneider, and A. C. Mathers.
Texas A and M University, Texas Agricultural Experiment Station, MP-935, October 1969. 7 p, 2 fig, 3 tab, 4 ref.

Descriptors: *Water utilization, *Irrigated land, *Sugar beets, *Texas, *Water management (Applied), Soil-water-plant relationships, Costs, Rainfall, Groundwater, Crop production, Climatic data, Soil moisture, Nuclear moisture meters, Seasonal, Diurnal, Water requirements, Irrigation water, Irrigation efficiency, Plant growth, Application methods, Semiarid climates.
Identifiers: *Irrigated crops, *Texas High Plains, *Growing season.

This article presents results of 1964-1967 sugar beet water use studies under climatic and cultural conditions of the Texas High Plains. Where the season extended from April to October, water use during 2 full growing seasons was 38 to 40 inches. Daily use exceeded 0.25 inch per day for 2 months. Good irrigation water management, which meets crop water requirements and minimizes groundwater use, is necessary. Well pumping capacity determines maximum irrigated sugar beet acreage. Utilization of rainfall and application of irrigated water furnish seasonal water requirements at the least cost. Because growing season rainfall is about 13 inches, it may furnish up to 30 percent of crop water needs. Irrigation efficiency is indicated by numerical examples and tables show climatic data, cultural practices and crop yields. Daily and cumulative water use by sugar beets during the study period is also included. (Popkin-Arizona)

W71-02963

CLIMATE AND SOILS,
Reading Univ. (England). Dept. of Soil Science.
E. W. Russell.
Agroclimatological Methods: Proceedings of the Reading Symposium, Natural Resources Research, Vol 7, p 193-200, UNESCO, 1968.

Descriptors: *Soil formation, *Geomorphology, *Weathering, *Soil water movement, *Climatology, Permeability, Rainfall, Drainage patterns (Geologic), Solar radiation, Erosion, Residual soils, Vegetation effects, Temperature, Weather, Evapotranspiration, River flow, Soil horizons, Soil profiles, Soil chemical properties, Soil physical properties, Montmorillonite, Mode of action, Rocks, Crystalline rocks, Arid climates, Semiarid climates, Humid climates, Humus, Clays, Hydrolysis, Solubility, Groundwater, Aluminum, Springs, Percolation, Infiltration, Root systems, Water conservation, Land forming, Ion exchange, Watersheds (Basins).
Identifiers: *Pans, *Potential evapotranspiration.

Rock weathering and soil formation involve decomposition in the weathering zone and the fate of the weathering products. The volume of weathering rock remains constant while density decreases. Hydrolysis of parent materials results in solubilization and removal of bases and some silica, while much of the Fe and Al remain behind. These processes vary according to temperature and drainage. In humid climates most of the soluble weathering products drain into rivers and oceans but in arid lands, high river evaporation concentrates solutes, resulting in Ca loss, increase in Na and either Si precipitation or accumulation of high exchange capacity siliceous clays. Under dry soil conditions Fe precipitates as ferric oxide and pans may develop around spring lines. Fe also affects soil permeability to water by tending to coat kaolin particles, creating well-structured permeable clays. Plants act as ionic pumps moving soluble materials from the soil to the surface and producing humus from litter decomposition and root debris. In areas where rainfall is at least equal to potential evapotranspiration, river flow is low but constant. If deep-rooted vegetation is replaced by shallow-rooted vegetation, such as crops, river flow will increase during the dry season when the moisture is needed by plants. Considerations of this kind should influence agricultural procedures. (Casey-Arizona)
W71-02970

AGROCLIMATOLOGICAL STUDIES IN THE LEVANT,
Swedish Meteorological and Hydrological Inst., Stockholm.
For primary bibliographic entry see Field 02B.
W71-02971

LAWN WATERING NEED NOT BE WASTEFUL,
Agricultural Research Service, Phoenix, Ariz. Water Conservation Lab.
Leonard J. Erie, Orrin F. French, and Lowell True.
University of Arizona, Cooperative Extension Service, Folder 143, November 1968. 11 p, 5 fig.

Descriptors: *Lawns, *Water conservation, *Water management (Applied), *Irrigation practices, *Irrigation effeciency, Soil moisture, Bermudagrass, Arizona, Arid lands, Soil-water-plant relationships, Leaching, Scheduling, Soil types, Consumptive use, Evaporation, Water loss, Saline water, Saline soils, Moisture stress, Water requirements, Rates of application, Water storage, Damages.
Identifiers: *Salt accumulation.

This folder describes techniques of efficient, economical, lawn watering. Water savings of several hundred percent can be achieved by better management of lawn irrigation in Arizona. Over-irrigation and poor scheduling waste water and nitrogen, and create grass yellowing, foundation settlement, street damage and septic tank problems. Soils are compared to a sponge storage reservoir where sandy soils hold only small amounts of water while loam, silt and clay hold more. Research studies on bermudagrass, visual water signals, optimum amount of water per irrigation and quantitative measures of lawn water needs offer solutions to excessive watering. Irrigation should be applied only when plants require water according to weather conditions, soil moisture depletion and visual plant needs. A water-need calculation is given in the brochure. Water should be applied only to replace depleted water and at a maximum depth of 5 inches on dry soil. Occasional deep leaching irrigation will wash out accumulated salts. In Arizona, one bermudagrass irrigation between October and March 15 will be adequate. Appropriate water management saves dollars, fertilizer, water, labor, street repairs and property damage. (Popkin-Arizona)
W71-02976

WATER, SOIL, AND CROP MANAGEMENT PRINCIPLES FOR THE CONTROL OF SALTS,
Arizona Univ., Tucson. Dept. of Agricultural Chemistry and Soils.
Wallace H. Fuller.
University of Arizona, Agricultural Experiment Station and Cooperative Extension Service, Bulletin A-43, Reprinted July 1967. 21 p, 6 fig, 1 tab, 20 ref.

Descriptors: *Soil management, *Water management (Applied), *Saline water, *Saline soils, *Crops production, Leaching, Salinity, Irrigation water, Water quality, Arid lands, Management, Irrigable land, Soil-water-plant relationships, Soil moisture, Nutrients, Toxicity, Salt balance, Cultivation, Salt tolerance, Irrigation efficiency, Irrigation practices, Arizona, New Mexico, Nevada, California, Salts, Planting management, Timing, Seeds, Rotations, Root systems, Soil water movement.
Identifiers: *Salt control, *Cultural practices, *Permanent agriculture, *Leaching requirement, Semiarid lands, Salt movement.

Arid and semiarid permanent agriculture depend on salt control in soils. Major salt sources are irrigation water and native soil. The manner in which water, soil and crops are managed will determine salt control for economic agricultural production. This bulletin discusses basic principles of water, soil and crop management of irrigated lands to prevent salt accumulation at harmful levels. Management concepts related to long-time irrigation for permanent agriculture are presented. Salt affects plants by reducing moisture, altering nutrient and root conditions, and causing toxicity. Leaching requirement concepts estimate necessary leaching to maintain a favorable salt balance. Water management practices include considerations of timing for irrigation leaching, frequency of irrigation for leaching, water quality and quantity, and salt movement. Soil management practices include tillage to improve water penetration, organic matter and crop residues, and crop-land selection. Cultural management practices include selection of salt-tolerant crops, seed placement and crop rotation. Special management practices permit economic irrigation with saline water in Arizona, New Mexico, Nevada and California. Such irrigation will become more common in order to more economically produce crops. An 18-term appendix, conversion factors and salt tolerance tables are presented. (Popkin-Arizona)
W71-02977

THE PERSISTENCE AND ANALYSIS OF ORGANOCHLORINE INSECTICIDES IN SOILS AND SEDIMENTS,
Wisconsin Univ., Madison. Dept. of Soil Science.
For primary bibliographic entry see Field 05A.
W71-02979

WATER CONTENT MEASUREMENT BY NEUTRON ATTENUATION FOR APPLICATION TO STUDY OF UNSATURATED FLOW OF SOIL WATER,
Washington State Univ., Pullman. Dept. of Agronomy.
Gordon L. Stewart, and Walter H. Gardner.
Available from NTIS as RLO-1543-5, $3.00 in paper copy, $0.95 in microfiche.n.d. 26 p.
Identifiers: *Soils, Moisture, *Hydrology, Neutron reactions, Thermal neutron cross sections, Nondestructive testing, Nuclear industrial applications, Moisture content, Ground water.

Adequate testing of the applicability of various equations to studies of unsaturated water flow in soil requires a precise method for water content measurement. A neutron-matter interaction technique has been developed in this investigation to measure water contents of small volume elements of soil accurately, rapidly, and at frequent time intervals. This method can be used to measure water content in many types of experiments but it is particularly well suited for experiments involving transient flow. High thermal neutron fluxes, available at the present time only from nuclear reactors, are required. The method is superior to existing methods for measuring, non-destructively, water content as a function of time and position. The inherent precision due to the random nature of neutron production with a neutron count in dry soil of 600,000 c/m, for 2 second counting and a resolution of 1 mm. by 1 cm. for dry and wet water content regions (about 5% and 40% water) are about .. 0.2% and ..0.4% water. For 30 second counting times the precisions improve to about .. 0.05% and 0.1% water. Longer counting times would lead to further improvement. Neutron attenuation is not seriously affected by density changes but soil bulk density can be measured by use of long counting times. Precision for soil bulk density measurement is about .. 0.002 gm./cm. (3) with counting times of about 200 seconds. With improved techniques and fluxes available at a 100 kw reactor it appears possible to improve the present resolution by a factor of 10 beyond that reported.
W71-03084

SOIL HYDRAULIC CONDUCTIVITY MEASUREMENT BY FIELD MONOLITHS,
Ohio Agricultural Research and Development Center, Wooster.
Ehud Stibbe, T. J. Thiel, and G. S. Taylor.
Soil Science Society of America Proceedings, Vol 34, No 6, p 952-954, November-December 1970. 3 p, 1 fig, 1 tab, 6 ref.

Descriptors: *Hydraulic conductivity, *Soil water movement, *Permeameters, *On-site tests, Instrumentation, Analytical techniques, Equipment, Infiltrometers, Lysimeters, Soil moisture meters, Water measurements.
Identifiers: *Soil monoliths (Permeameters).

A method is described for evaluating the saturated hydraulic conductivity (K) of field soils. Vertical water flow in relatively large (over 1.5 sq m) in situ monoliths provides K values that are reproducible and agree well with other techniques for evaluating K. In 1963, two soil monoliths were constructed adjacent to drainage plots on a very poorly drained Toledo silty clay. This soil is a Humic-Gley (Mollic Haplaquept) developed in lacustrine mixed clays and silts, and fractures extensively upon wetting and drying. Perforated plastic pipes (piezometers) were inserted at the lower Ap, the lower B, the upper C horizon interfaces, and at 152 cm. Because only vertical flow occurs in the monoliths, conductivity rates are directly applicable to infiltration, deep seepage, and other situations where vertical flow predominates. Because monoliths require relatively large investments in time and labor, their use may be limited to special situations. Preliminary studies may be made for more costly operations that are dependent on soil flow characteristics. Some examples are drainage installations, aquifer recharge studies, and septic tank leach bed studies. Hydraulic conductivity data can be collected for a

few selected soils in an area. Soil morphological data could then be used to estimate the conductivity of other soils. (Knapp-USGS)
W71-03142

SEPARATION OF ADSORBED CATION SPECIES AS WATER FLOWS THROUGH CLAYS,
Agricultural Research Service, Beltsville, Md., Soil Lab.
For primary bibliographic entry see Field 02K.
W71-03143

THE INFLUENCE OF SOIL WATER MATRIC POTENTIAL ON THE STRENGTH PROPERTIES OF UNSATURATED SOIL,
Manitoba Univ., Winnipeg. Dept. of Soil Science.
John Williams, and C. F. Shaykewich.
Soil Science Society of America Proceedings, Vol 34, No 6, p 835-840, November-December 1970. 6 p, 5 fig, 1 tab, 24 ref.

Descriptors: *Soil strength, *Soil moisture, *Moisture tension, *Effective stress, *Shear stress, Mechanical properties, Soil physical properties, Soil physics, Soil-water-plant relationships.
Identifiers: *Matric potential-soil strength relations.

A study was made of the contribution that matric potential makes to effective stress and therefore the strength properties of two unsaturated soils. The effective stress parameters and the unconfined strength were measured, and the shear strength, effective stress, and a saturation factor were estimated as a function of soil water matric potential over the range-0.59 to -15.1 bars. The strength properties of a Gretna clay increased rapidly with decreasing matric potential. In a Wellwood loam, however, the strength properties remained relatively constant over the range -0.59 to -15.1 bars. A measure of the proportion of the matric potential operative in the effective stress is given by the saturation factor. The influence that matric potential has on the strength of an unsaturated soil is related to the moisture retention properties of the soil. (Knapp-USGS)
W71-03144

INDICES FOR CHARACTERIZING SOIL-WATER REPELLENCY BASED UPON CONTACT ANGLE-SURFACE TENSION RELATIONSHIPS,
California Univ., Riverside. Dept. of Soils and Plant Nutrition.
C. L. Watson, and J. Letey.
Soil Science Society of America Proceedings, Vol 34, No 6, p 841-848, November-December 1970. 8 p, 3 fig, 4 tab, 14 ref.

Descriptors: *Wettability, *Soil physical properties, *Soil chemical properties, *Wetting, Solvents, Surfactants, Moisture tension, Soil water movement, Infiltration, Recharge, Surface tension, Porous media.
Identifiers: *Water-repellent soils.

The relation between apparent liquid-solid contact angle and surface tension was established for three water repellent materials using both a series of aqueous ethanol solutions and organic liquids. The media included two artificially treated sands and one naturally occurring soil. With one exception there was an approximate linear relationship between the cosine of the contact angle and the surface tension. The relationship for the forest soil tended to be curvilinear when using ethanol solutions of high surface tension. A simple drop test using the same materials and ethanol solutions placed the materials in the same order of repellency. The drop test was further developed to allow classification of porous media on the basis of 90 deg surface tension and stability to water interaction. The tests can be readily performed both in the laboratory and the field. Two indices are given to describe water-repellent characteristics of soils. These indices are valuable in assessing erosion and runoff problems, and also the feasibility of surfactants to promote infiltration. (Knapp-USGS)
W71-03145

A MATHEMATICAL SOLUTION TO A HILLSIDE SEEPAGE PROBLEM,
Arizona Univ., Tucson. Dept. of Agricultural Chemistry and Soils.
A. W. Warrick.
Soil Science Society of America Proceedings, Vol 34, No 6, p 849-853, November-December 1970. 5 p, 7 fig, 1 tab, 8 ref.

Descriptors: *Soil water movement, *Groundwater movement, *Slopes, Mathematical studies, Infiltration, Drainage, Subsurface runoff, Topography, Seepage.
Identifiers: *Hillside seepage.

A solution is presented for a two-dimensional hillside seepage problem. The soil is assumed to be water-saturated to the soil surface where the soil water is at atmospheric pressure. Seepage occurs into the flow medium along the upper part and out along the lower part of the sloping soil surface. The flow medium is infinitely deep and bounded laterally by vertical streamlines. Conformal transformations are used to find the hydraulic head and stream functions. Although the solution is analytic, a complex integral must be evaluated numerically for application. Numerical data presented includes flownets, seepage velocities, infiltration angles, and volume of flow as a function of slope. (Knapp-USGS)
W71-03146

2H. Lakes

TOWARD THE FAUNA OF OSTRACODA IN RYBINSK RESERVOIR,
L. A. Luferova.
Available from NTIS as PB-189 285T, $3.00 in paper copy, $0.95 in microfiche. BIOLOGIYA I TROFICHESKIE SVYAZI PRESNOVODNYKH BESPOZVONOCHNYKH I RYB. SBORNIK STATE I. AKADEMIYA NAUK SSSR, INSTITUT BIOLOGII VNUTRENNIKH VOD, TRUDY, NO. 17 (20) 'NAUKA', LENINGRAD, 1968, p 76-81. Russian transl. by Narragusett Marine Game Fish Research lab., July 1969. 9 p, 4 fig, 7 ref.
Identifiers: *Crustacea, *Ecology, Distribution, Population, Classification, Periodic variations, Marine biology, Lakes, USSR, *Ostracoda.

The majority of ostracods are poor swimmers. They live on the botton, in the pelogen, and on the surface of plants. However, at slight depths not exceeding lm, their entry into the water mass with the dense turbidity of the bottom in the littoral zone is quite possible. In the majority of cases ostracods yield in abundance to copepods and cladocerans, although in some cases (early spring, isolated days in July and August, at the start of winter) there were more of them than cladocerans, and in April and December they surpassed the other crustaceans in number. For clarification of the species composition of ostracods, the seasonal dynamics of their abundance, and the primary sites of habitation, 4 fixed stations were set up in the littoral zone of the reservoir near Borka. Material was collected once every 10 days from the end of May through November at these stations.
W71-02842

NUTRITIVE RATIONS AND FOOD COEFFICIENTS OF PREDATORY FISHES IN RYBINSK RESERVOIR,
M. N. Ivanova.
Available from NTIS as PB-189 891T, $3.00 in paper copy, $0.95 in microfiche. BIOLOGIYA I TROFICHESKIE SVYAZI PRESNOVODNYKH BESPOZVONOCHNYKH I RYB. SBORNIK STATE. AKADEMIYA NAUK SSSR, INSTITUT BIOLOGII VNUTRENNIKH VOD, TRUDY, NO. 17 (20), 'NAUKA', LENINGRAD, 1968, p 180-198. Russian Translation by Narragauset Marine Game Fish Research Lab., June 1969. 27 p.
Identifiers: *Fishes, Food, *Lakes, Fishes, Aging (Physiology), Population, Ecology, Nutrition, Ingestion (Physiology), Periodic variations, Weight, Food chains.

The rations and food coefficients of different species of predators change rather substantially in relation to age. The magnitude of annual rations varies in relation to foraging conditions in a particular year. The fattening conditions of juvenile pike, pikeperch, burbot and perch in the reservoir are relatively constant. The amount of food eaten by adult predators (3-7 years) in years which have different foraging conditions (abundant water and scant water) is subject to great variations. Their annual rations can change rather substantially; for example, in the pikeperch from 0.7 to 2.0. in the pike from 3.4 to 5.7 etc. Food coefficients in all predators increase considerably with age. The largest coefficient is in the burbot - a psychrophilic species which feeds primarily during winter. The feeding spectrum is narrower in the burbot than in the other predators in Rybinsk Reservoir. The lowest food coefficient and consequently also the amount of food eaten per unit of growth, occurs in the pikeperch. The factors which determine the size of the food coefficient are the degree of mobility of the fish and the rate of its weight increase. Therefore in predators which are not very mobile and lead a demersal way of life, the food coefficient is less than in mobile inhabitants of the water thickness.
W71-02843

SOME CHARACTERISTICS OF THE OPERATIONAL RESERVOIRS IN THE ISRAEL NATIONAL WATER SYSTEM,
H. Leventer.
Internationale Vereinigung fur Theoretische und Angewandte Limnologie, Verhandlungen, Vol 17, p 1017-1030, November 1969. 3 tab, 10 fig, 16 ref.

Descriptors: *Impounded waters, *Reservoir operation, *Water supply, *Water quality, *Limnology, Consumptive use, Arid lands, Organic matter, Plant growth, Nutrients, Dissolved oxygen, Stratification, Phytoplankton, Nitrogen compounds, Diatoms, Reservoirs, Water chemistry, Chemical properties, Phosphates, Decomposing organic matter, Sediments, Algae, Reservoir stages, Potable water, Water level fluctuations, Benthos.
Identifiers: *Impoundment effects, *Israel National Water System, *Bottom settling, *Submerged plant growth, Tsalmon Reservoir (Israel), Netofa Reservoir (Israel), Zohar Reservoir (Israel), Microstratification, Turnover.

Tsalmon, Netofa and Zohar are the most important reservoirs of the Israel National Water System, which supplies ground and surface waters for drinking and agricultural purposes. These 3 reservoirs are described in terms of impoundment influence on water quality. Zohar, in the south, was filled in 1960. Tsalmon and Netofa, in the north, were filled in 1964. Three stages of youthful reservoir regime are noted: (a) bottom settling of organic matter (January to April); (b) intensified decomposition of organic matter (April to June); and (c) abundant growth of submerged plants (July to November). Zohar Reservoir functions by the 'floating on the system' method, where high nutrient concentration permits dissolved oxygen (D.O.) stratification on phytoplankton growth. Frequent water level fluctuations decrease the algae quantity and break stratification. Because the northern reservoirs function in series, phytoplankton do not develop but settle to the bottom. Source water chemical composition and reservoir water properties (temperature, Secchi disc, D.O., stratification, P and N compounds, phytoplankton, limnological and bottom conditions) are discussed. Also mentioned are turnover, diatom abundance, microstratification, and plankton assemblages. Tables show chemical composition of source water and reservoir sediment and reservoir P and N concentrations. Figures show dominant reservoir

plankton and distribution, reservoir and source chemistry, and reservoir location. (Popkin-Arizona)
W71-02871

CHEMICAL, PHYSICAL AND BIOLOGICAL DYNAMICS OF NORTHERN PRAIRIE LAKES,
South Dakota State Univ., Brookings.
For primary bibliographic entry see Field 05C.
W71-02880

THE REPRODUCTIVE CYCLE OF DAPHNIA IN AN ARCTIC POOL,
Arctic Inst. of North America, Washington, D.C.
R. G. Stross, and D. A. Kangas.
Available from NTIS as AD-711 214, $3.00 in paper copy, $0.95 in microfiche. Ecology, Vol 50, No 3, p 457-460, Late Spring 1969. 2 fig, 15 ref. ONR-307 105.
Identifiers: *Arthropods, Reproduction, Physiology, *Reproduction (Physiology, *Arctic regions, Life cycle, Temperature, Metabolism, Insects, Entomology, *Daphnia.

The reproductive cycle of Daphnia middendor ffiana living in an arctic pool and an arctic lake is essentially the same. An overwintering generation produces one brood of young before shifting to produce broods of embryos which enter diapause. The pool warms more rapidly than the lake and has twice the number of day degrees above 0C. The higher temperature acts only to accelerate the development rate of the Daphina, and the reproductive shift occurs in mid-July rather than in late August. The restriction of population growth to one brood of young in the warmer pool and colder lake is used to illustrate the hypothesis that artic temperature influences reproductivity by controlling life cycle rather than by restricting rates of metabolism.
W71-02956

EXTRACTION AND ANALYSIS OF ORGANOCHLORINE INSECTICIDES FROM LAKE SEDIMENTS,
Wisconsin Univ., Madison. Dept. of Soil Science.
For primary bibliographic entry see Field 05A.
W71-02978

STUDIES ON THE INTERACTIONS OF AQUATIC BACTERIA AND AQUATIC NEMATODES,
Auburn Univ., Ala. Water Resources Research Inst.
For primary bibliographic entry see Field 05G.
W71-03013

THE EFFECTS OF COPPER SULFATE ON CERTAIN ALGAE AND ZOOPLANKTERS IN WINNISQUAM LAKE, NEW HAMPSHIRE,
New Hampshire Univ., Durham. Water Resources Research Center.
For primary bibliographic entry see Field 05F.
W71-03014

BIOGEOCHEMICAL MODELING OF EUTROPHIC LAKES FOR WATER QUALITY IMPROVEMENT,
Notre Dame Univ., Ind. Dept. of Civil Engineering.
For primary bibliographic entry see Field 05G.
W71-03021

A TWO-YEAR STUDY OF BACTERIAL POPULATIONS IN INDIANA FARM POND WATERS,
Purdue Univ., Lafayette, Ind. Agricultural Experiment Station.
For primary bibliographic entry see Field 05G.
W71-03023

ACETYLENE REDUCTION ASSAY FOR DETERMINATION OF PHOSPHORUS AVAILABILITY IN WISCONSIN LAKES,
Wisconsin Univ., Madison. Dept. of Biochemistry.
For primary bibliographic entry see Field 07B.
W71-03024

NUTRIENTS AND QUALITY IN IMPOUNDED WATER,
Illinois State Water Survey, Peoria. Water Quality Section.
For primary bibliographic entry see Field 05C.
W71-03028

AUTOECOLOGICAL AND SAPROBIOLOGICAL INVESTIGATIONS OF FRESH WATER CILIATES (IN GERMAN),
Bonn Univ. (Germany). Zoological Inst.
For primary bibliographic entry see Field 05G.
W71-03031

THE SEASONAL SUCCESSION AND DISTRIBUTION OF PLANKTONIC DIATOMS IN UNIVERSITY LAKE IN RELATION TO SILICON CONCENTRATIONS,
North Carolina Univ., Chapel Hill. Dept. of Environmental Sciences and Engineering.
John A. Soyak.
MS Thesis in Public Health, Univ of North Carolina, Dep of Environmental Sciences and Engineering, 1970. 31 p, 30 fig, 13 tab, 47 ref. OWRR Project B-003-NC (2) and B-007-NC (1).

Descriptors: *Seasonal, *Succession, *Distribution, *Plankton, *Diatoms, North Carolina, Epilimnion, Depth, Silica, Thermocline, Isotherms, Dissolved oxygen, Light penetration, Temperature, Turbidity, Hydrogen ion concentration, Spectrophotometry, Agricultural watersheds, Geologic formations, Chemical reactions, Absorption.
Identifiers: *Silicon cycle, University Lake (NC), Synedra ulna, Synedra delicatissima, Synedra rumpens, Bottom stratum, Biological uptake.

An investigation of University Lake (North Carolina) was made to determine seasonal succession and distribution of planktonic diatom populations, taking into consideration concentration of silicon and various chemical, physical, and biological parameters affecting their distribution. Spectrophotometry was utilized for determination of silicon. Frustules of dead diatoms and suspended material in the epilimnion settle out of the water mass according to Stokes law. While held in suspension, re-solution of the silicon took place creating an inverse clinograde depth distribution. Evidence indicates that a complicated succession of diatom maxima and minima occurred throughout the year. Individual diatom numbers were greatest during the summer but the silicon level in the epilimnion increased steadily throughout this period. Thus, it was not large diatom populations or 'blooms' which were associated with reduction in silicon but rather individual species. The greatest biological uptake of silicon occurred during April-May when the diatom diversity was largest. Three diatom species, Synedra ulna, Synedra delicatissima, and Synedra rumpens were associated with this spring decrease in silicon concentration within the epilimnion. An inverse clinograde depth distribution of silicon was observed during the summer with the highest concentration in the bottom water stratum. (Jones-Wisconsin)
W71-03037

A COMPARATIVE PRE- AND POST-IMPOUNDMENT SURVEY OF THE HELMINTH AND CRUSTACEAN PARASITES OF MICROPTERUS SALMOIDES (LACEPEDE) AND M PUNCTULATUS (RAFINESQUE) (PERCIFORMES) IN BEAVER RESERVOIR, ARKANSAS,
Arkansas Univ., Fayetteville. Dept. of Zoology.
Mitchell D. Norman.
MS Thesis, Dep of Zoology, University of Arkansas, Fayetteville, 1970. 96 p, 4 fig, 4 tab, 68 ref. OWRR Project A-009-ARK (4).

Descriptors: *Reservoirs, *Surveys, *Parasitism, Crustaceans, Arkansas, Infection, Watersheds (Basins), Bass, Trematodes, Nematodes, Snails, Plankton, Copepods, Fish, Worms.
Identifiers: *Helminth, *Micropterus salmoides, *Micropterus punctulatus, Beaver Reservoir (Ark), Urocleidus furcatus, Urocleidus principalis, Actinocleidus fusiformis, Clavunculus bursatus, Cestodes, Hirundinea, Acanthocephala, Posthodiplostemum minimum, Metacercariae, Neoechinorhynchus clindratum.

A comparative pre- and post-impoundment survey of helminth and crustacean parasites of Micropterus salmoides and M punctulatus was made. Monogenetic trematode incidence increased following impoundment. Percent infection of Urocleidus furcatus and U principalis decreased in 1967 in Micropterus punctulatus. In 1967 Actinocleidus fusiformis decreased in M punctulatus. The 1964 survey showed U furcatus and U principalis did not follow monogenetic trematode pattern. Clavunculus bursatus inclined to decrease following impoundment until 1967; monogenetic trematode incidence decreased in upper reservoir in 1967. Parasites developing with a change of hosts decreased immediately following impoundment. In a post-impoundment survey, Posthodiplostemum minimum did not show fluctuations in per cent infection the first two impoundment years, attributable to viability of metacercariae within the hosts. Tremendous increase in incidence of P minimum and Neoechinorhynchus cylindratum in 1966 suggests their intermediate hosts adjusted to the new environment within two years. P ambloplitis larvae showed higher infection incidence in lower reservoir in 1964. With impoundment of that reservoir portion, parasites utilizing plankton forms would probably decrease. Adult stage of P ambloplitis increased in upper reservoir in 1966. Incidence of Ergasilus caeruleus followed that of parasites with direct life cycles, apparently stabilizing in 1966. (Jones-Wisconsin)
W71-03040

ON RECONCILING LAKE CLASSIFICATION WITH THE EVOLUTION OF FOUR OLIGOTROPHIC LAKES IN OREGON,
Oregon State Univ., Corvallis. Dept. of Fisheries and Wildlife.
Douglas W. Larson.
Ph D Thesis, Dep of Fisheries and Wildlife, Oregon State University, Corvallis, 1970. 145 p, 29 fig, 14 tab, 155 ref. A-003-ORE (1).

Descriptors: *Oligotrophy, *Lakes, *Oregon, *Classification, Phytoplankton, Primary productivity, Carbon radioisotopes, Bioassay, Chlorophyll, Watershed (Basins), Elevation, Optical properties, Thermal properties, Water chemistry, Biomass, Geology, Eutrophication, Climates, Temperature, Dissolved oxygen, Zooplankton, Chlorophyta, Cyanophyta, Chrysophyta, Daphnia, Fish, Shrimp, Mayflies, Benthos, Photosynthesis, Phosphorus, Dissolved solids, Soils, Recreation, Energy, Limnology.
Identifiers: *Lake evolution, Crater Lake (Ore), Odell Lake (Ore), Waldo Lake (Ore), Woahink Lake (Ore), Morphometry.

Data were collected from four oligotrophic Oregon lakes--Crater, Odell, Waldo, and Woahink. Phytoplankton primary production was estimated periodically using a standard carbon-14 in situ method. Bioassays were conducted to determine whether water samples, treated with various kinds and concentrations of inorganic nutrients, might stimulate phytoplankton carbon uptake. Chlorophyll a measurements complemented production estimates. Comparing the lakes, differences in origin, watershed features, basin morphometry, surface elevation, optical and thermal properties, and water chemistry were noted; more significant were differences in phytoplankton

primary production and biomass. During July and August 1969, productivity averaged 253.1 (Crater), 1533.2 (Odell), 35.5 (Waldo), and 301.1 (Woahink) mg carbon/sq m per day; concentrations of chlorophyll a averaged 34.4 (Crater), 99.03 (Odell), 4.7 (Waldo), and 24.7 (Woahink) mg/sq m, resulting from the different usages the lakes receive. Judging by productivity, lakes seem to be unique environments evolving at different rates in response to natural and artificial (culture use) enrichment. A classification system, based on relationship between phytoplankton primary productivity and light energy absorbed by phytoplankton for photosynthesis is proposed to diagnose, to a degree, causes of eutrophication to provide instantaneous productivity assessment. (Jones-Wisconsin)
W71-03042

ENERGY FLOWS IN THE PELAGIC ECOSYSTEM OF THE LAKE DALNOE (KAMCHATKA) (IN RUSSIAN),
E. M. Krokhin.
Doklady Akademii nauk SSSR, Vol 189, No 5, p 1118-1121, 1969. 1 fig, 1 tab, 6 ref.

Descriptors: *Energy transfer, *Productivity, *Lakes, Trophic level, Primary productivity, Fish, Zooplankton, Phytoplankton, Nutrients.
Identifiers: Lake Dalnoe (USSR), Pelagic ecosystem.

The flow of energy in an ecosystem is synonymous with the transfer of food from one to another trophic level. In Lake Dalnoe (Kamchatka, USSR), the production in the higher trophic level is about 1/10th of that of the food source level. Thus, the annual production in potassium cal/sq m or in percent of the primary production is given by the following sequence: Phytoplankton - 2435 (100%), zooplankton - 282 (11.6%), planktophagous fish - 37 (1.5%), predatory fish - 2.6 (0.1%). (Wilde-Wisconsin)
W71-03044

MOVEMENT OF PHOSPHATE AND OTHER IONS FROM AND THROUGH LAKE MUDS,
Waterloo Univ. (Ontario). Dept. of Biology.
H. B. N. Hynes, and B. J. Greib.
Journal Fisheries Research Board of Canada, Vol 27, No 4, p 653-668, 1970. 4 fig, 1 tab, 23 ref.

Descriptors: *Mud-water interfaces, *Lakes, *Eutrophication, *Water quality control, Phosphorus, Ions, Iron, Ammonia, Oxygen, Tracers, Sands.
Identifiers: *Eutrophication control, *Polyethylene coverings, Paradise Lake (Canada), Abiotic movement.

Covering of undisturbed or disturbed lake muds with sheets of polyethylene or a layer of sand reduced the loss of oxygen in the overlying water and greatly decreased the release of phosphate, iron, and ammonium from the sediment. Injections of ammonium and phosphates, including phosphorus-32 labeled fertilizer, 4 cm below the mud-water interface disclosed that both nitrogen and phosphorus move readily upwards into water from either rich calcareous muds or peat-like acid muds. A suggestion is offered that covering bottoms of valued lakes with polyethylene may counteract the process of eutrophication. (Wilde-Wisconsin)
W71-03045

ESTIMATES OF SESTON CROPS BY FILTRATION WITH GLASS FIBER DISCS,
Colorado Dept. of Game, Fish and Parks, Glenwood Springs; and Colorado State Univ., Fort Collins. Dept. of Zoology.
Dale F. Reed, and Edward B. Reed.
Journal Fisheries Research Board of Canada, Vol 27, No 1, p 180-185, 1970. 3 fig, 4 tab, 7 ref.

Descriptors: *Analytical techniques, *Seston, *Filtration, *Gravimetric analysis, Reservoirs, Colorado, Diatoms, Chlorophyta, Zooplankton, Cyanophyta, Pigments, Nannoplankton, Oligotrophy, Lakes, Phytoplankton, Detritus.
Identifiers: *Glass fiber discs, Dixon Reservoir (Colo), Optical density, Dry weight.

The primary objective of this study was to compare the effectiveness of glass fiber filters with centrifugation in removing seston from natural lake water containing mixed populations of phyto- and zooplankters as well as organic and inorganic detritus. The comparison was made by concentrating seston from a small fluctuating reservoir. Fifteen sets of samples drawn over a 2-month period showed that the filters removed about twice as much seston, by dry weight, as did the centrifuge. In view of current interest in the extraction of pigments from seston, a secondary objective was to compare optical densities of extracts from seston obtained by filtration with those obtained by centrifugation. Complete solution of pigments, as indicated by greenish or more frequently, bluish-green color remaining on wet filters after extraction, was not achieved. Filtration is quicker and requires less sample water than centrifugation. (Jones-Wisconsin)
W71-03051

EFFECTS OF CONTROLLED NUTRIENT DILUTION ON THE EUTROPHICATION OF A LAKE,
Washington Univ., Seattle. Dept. of Civil Engineering.
For primary bibliographic entry see Field 05C.
W71-03057

EFFECT OF RECENT ACIDIFICATION OF WATER ON THE PLANKTON ORGANISMS IN LAKE TOYA, HOKKAIDO (IN JAPANESE),
Hokkaido Univ., Sapporo (Japan). Plankton Lab.
For primary bibliographic entry see Field 05C.
W71-03102

2I. Water in Plants

A SHORT STUDY ON CONSUMPTIVE USE AND THE DATA REQUIRED IN IRAN,
Iran Plan Organization, Tehran. Water Planning Group.
For primary bibliographic entry see Field 03F.
W71-02803

MICRO-CLIMATE EVALUATION OF HEATING IRRIGATION WATER ON COTTON AND THE RESULTING EFFECT ON COTTON YIELD AND QUALITY,
High Plains Research Foundation, Plainview, Tex.
James Valliant, and T. C. Longnecker.
Symposium on Thermal Agriculture, Sixth, January 22-23, 1969, Atlanta, Georgia, Proceedings, p 40-41, 1969. 5 tab.

Descriptors: *Irrigation practices, *Cotton, *Thermal water, *Temperature, Crops, Irrigation effects, Texas, Rainfall, Productivity, Soil temperature, Agronomic crops, Field crops, On-site investigations, Environmental effects, Water temperature, Crop production, Crop response, Microenvironment, Heated water, Air temperature.
Identifiers: *Thermal agriculture.

Cotton crops were irrigated over 3 years with heated water of 65-85 degree F. temperature ranges in an effort to determine the effects on crop yield. Irrigation treatment included: (1) preplant irrigation only, (2) preplant plus 2 irrigations and (3) preplant plus 2 irrigations with heated water. Heated and unheated water both reduced soil temperature 1-6 degrees F. below air temperature. Heated water had no consistent effect earlier flowering, the number of bolls or earlier cotton production. (Casey-Arizona)
W71-02859

FORAGE POTENTIAL OF IRRIGATED BLUE GRAMA WITH NITROGEN FERTILIZATION,
Southwestern Great Plains Research Center, Bushland, Tex.
For primary bibliographic entry see Field 02G.
W71-02861

APPARENT SAP VELOCITIES IN BIG SAGEBRUSH AS RELATED TO NEARBY ENVIRONMENT,
Renewable Resources Center, Reno, Nev.
Gerald F. Gifford.
Journal of Range Management, Vol 21, No 4, p 266-268, July 1968. 5 fig, 1 tab, 5 ref.

Descriptors: *Arid lands, *Sagebrush, *Transpiration, *Physiological ecology, *Microenvironment, Xerophytes, Nevada, Temperature, Wind velocity, Solar radiation, Humidity, Regression analysis, On-site investigations, Velocity, Soil moisture, Soil-water-plant relationships, Shrubs, Heat transfer, Niches, Environmental effects, Ecosystems, Habitats, Plant physiology, Great Basin, Water loss.
Identifiers: *Sap velocity, Relative humidity, *Heat pulse technique.

The major factor in xerophyte ecology is plant-water relations. The big sagebrush (Artemesia tridentata Nutt.) is probably the most abundant and widespread xerophyte in the U.S., but the factors influencing its transpiration have been little studied. A sagebrush community in alluvially derived soils with no profile development was studied in western Nevada. Sap stream velocities were measured by the heat pulse method and correlated with 15 measured environmental variables. A 30-variable multiple regression equation accounted for only 54.05% of sap velocity variability. While sap flow velocities cannot be directly correlated with yearly transpirational volume, it would appear that physiological control is a major determinant of transpirational water losses. (Casey-Arizona)
W71-02863

SORGHUM FOLIAR RESPONSES TO CHANGES IN SOIL WATER CONTENT,
Agricultural Research Service, Phoenix, Ariz. Water Conservation Lab.
For primary bibliographic entry see Field 02D.
W71-02865

STRUCTURE AND FUNCTION OF THE KIDNEY AND THE WATER BALANCE OF DESERT BATS,
San Diego State Coll., Calif. Dept. of Zoology.
Roger E. Carpenter.
Physiological Zoology, Vol 42, No 3, p 288-302, July 1969. 5 fig, 3 tab, 37 ref. NSF Grant GB-4570.

Descriptors: *Water loss, *Water balance, *Animal behavior, *Physiological ecology, *Xerophilic animals, Arid lands, Laboratory tests, Animal metabolism, Aestivation, Heat resistance, Water conservation, Heat budget, Environmental effects, Mammals, Digestion, Mode of action, Moisture stress, Respiration, Diets, Food habits, Ureas, Chlorides, Migration, Evaporation, Habitats, Selectivity.
Identifiers: *Animal thermoregulation, *Bats, *Renal concentration mechanisms, *Renal structure, *Torpor.

Bats are probably the most successful arid zone mammals, suggesting the possibility of unique physiological water conservation mechanisms. Two arid zone insectivorous species, Tadarida brasiliensis and Eptesicus fuscus and one occasional arid zone nectar-feeding species, Leptonycteris sanborni, were studied and compared in terms of thermoregulation, excretory and evaporative water loss and kidney structure. The insectivorous species thermoregulated during daytime torpor with reduced evaporative water losses while Leptonycteris was always homeothermic with small water loss variations. Water losses therefore reflected general behavioral and thermoregulatory patterns. E. fuscus maintained body weight on protein diets

as high as 23.2% while some T. brasiliensis tolerated 28.3%. The insectivorous bats also tolerated much higher dietary salt levels and this was reflected in extremely thick renal medullary tissue which is a general phenomenon in desert-inhabiting, urine-concentrating mammals. The water conservation mechanisms of these animals is discussed in terms of their ecology and it is concluded that: (1) although they have high urine-concentration capacities, the primary water conservation of the insectivorous species is the behavioral adaptation of flying long distances to free water and (2) the nectar diet of L. sanborni obviates the necessity of renal concentration and allows an independence of free water. (Casey-Arizona)
W71-02866

INFLUENCE OF MINERALS ON SR90 AND CS137 UPTAKE BY BEAN PLANTS,
California Univ., Los Angeles. Lab. of Nuclear Medicine and Radiation Biology.
For primary bibliographic entry see Field 05C.
W71-02867

ALFALFA FOR FORAGE PRODUCTION IN ARIZONA,
Arizona Agricultural Experiment Station, Tucson.
For primary bibliographic entry see Field 02G.
W71-02868

BARLEY--DATES AND RATES OF PLANTING,
Arizona Agricultural Experiment Station, Tucson.
A. D. Day, and R. K. Thompson.
Progressive Agriculture in Arizona, Vol 22, No 4, p 6-7, 16, July-August 1970. 2 tab.

Descriptors: *Planting management, *Barley, *Rates, *Timing, *Plant growth, Arizona, Soil-water-plant relationships, Lodging, Arid lands, Consumptive use, Crop production, Optimization, Irrigation practices, Seeds, Moisture availability, Grains (Crops), Irrigation practices, Irrigation efficiency.
Identifiers: *Planting rates, *Planting dates, *Crop yield potential, Maximum tillering, Mesa Experiment Station (Arizona).

Dates and rates of planting are important because of their effects on growth and development of all agricultural plants. Optimum date and rate of seeding crops is knowledge essential for maximum production of high quality plant products. Arizona barley is planted in November or December and harvested in May or June of the following year. This study was undertaken to determine optimum date and rates of planting barley grown under irrigation in Arizona. Harlan and Arivat barley plots were studied at the Mesa Experiment Station, Arizona. Early planting saves water, as one irrigation is eliminated, and saves seeding rate, since vegetative period in which to tiller and develop roots is longer. Optimum dates and rates will differ with varieties. Minimum rates of planting are suited to November and December planting dates because temperatures and winter moisture are conducive to prolonged vegetative period and maximum tillering. Present barley planting rates could be decreased without decreasing grain yields. Arizona growers should plant high quality seed at lower rates to increase yield potential and grain quality by reducing lodging. Tables show average grain yields, volume rates, and numbers of heads and seeds for barley plots from 1961 to 1965. (Popkin-Arizona)
W71-02872

MERCURY CONTENT OF PLANTS,
Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 05B.
W71-02893

IRRIGATION: WHEN-HOW MUCH-HOW,
Arizona Univ., Tucson. Cooperative Extension Service.
For primary bibliographic entry see Field 02G.
W71-02958

SALT CONCENTRATIONS IN SOILS FURROW-IRRIGATED WITH SALINE WATERS,
Texas Agricultural Experiment Station, College Station.
For primary bibliographic entry see Field 02G.
W71-02961

GRAIN SORGHUM ROW SPACING AND PLANTING RATES UNDER LIMITED IRRIGATION IN THE TEXAS HIGH PLAINS,
Agricultural Research Service, Bushland, Tex. Southwestern Great Plain Research Center.
For primary bibliographic entry see Field 03F.
W71-02962

WATER USE BY IRRIGATED SUGAR BEETS IN THE TEXAS HIGH PLAINS,
Agricultural Research Service, Bushland, Tex. Southwestern Great Plains Research Center.
For primary bibliographic entry see Field 02G.
W71-02963

THE INFLUENCE OF XYLEM ARRANGEMENT AND TRANSPIRATION ON THE DISTRIBUTION OF SOLUTES IN COTTON,
Texas A and M Univ., College Station. Dept. of Plant Sciences.
For primary bibliographic entry see Field 02D.
W71-02968

LAWN WATERING NEED NOT BE WASTEFUL,
Agricultural Research Service, Phoenix, Ariz. Water Conservation Lab.
For primary bibliographic entry see Field 02G.
W71-02976

WATER, SOIL, AND CROP MANAGEMENT PRINCIPLES FOR THE CONTROL OF SALTS,
Arizona Univ., Tucson. Dept. of Agricultural Chemistry and Soils.
For primary bibliographic entry see Field 02G.
W71-02977

PHYSIOLOGICAL AND BIOCHEMICAL CONTRIBUTIONS TO THE TAXONOMY OF THE GENUS CHLORELLA. IV. UTILIZATION OF ORGANIC NITROGEN COMPOUNDS (IN GERMAN),
Erlangen-Nuremberg Univ. (West Germany). Botanisches Institut.
Erich Kessler, and Franz-Christian Czygan.
English summary. Archiv fur Mikrobiologie, Vol 70, p 211-216, 1970. 1 tab, 16 ref.

Descriptors: *Chlorella, *Plant morphology, *Nitrogen, Amino acids, Classification, Nutrients.
Identifiers: *Chlorella kessleri, Nicotinamide, Chlorella luteovirdis, Organic nitrogen, Glutamic acid, Glutamine, Nicotinic acid, Purine.

A total of 71 autotrophic strains of Chlorella, belonging to 8 species, were investigated as to their ability to utilize different forms of nitrogen. Glutamic acid provided a satisfactory diet for 63 and glutamine for 67 strains; nicotinic acid was used by 1, nicotinamide by 9, and purine by 16 strains. The 7 strains of Chlorella kessleri on a diet of nicotinamide exhibited strikingly better growth than that of morphologically similar Chlorella luteoviridis and other species. However, utilization of the 5 investigated nitrogen sources cannot serve as a taxonomic criterion for this genus of algae. (Wilde-Wisconsin)
W71-03032

CRYPTOGAMIC PLANTS OF THE U.S.S.R. VOLUME VII, SILICOFLAGELLATOPHYCEAE,
National Science Foundation, Washington, D.C. Special Foreign Currency Science Information Program.
Z. I. Glezer.
Transl. of Flora Sporovykh Rastenii SSSR; VII, Kremnevie Zhgutikovye Vodorosli, Moscow 1966. Available from NTIS as TT-70-50046, $3.00 in paper copy, $0.95 in microfiche. Israel Program for Scientific Translations, Jerusalem, 1970. 363 p.
Identifiers: *Aquatic plants, USSR, *Algae, Morphology, Ecology, Translations, Reproduction, Physiology, Taxonomy, Distribution, Evolution, *Cryptogamic plants, *Silicoflagellata.

History of studies of silicoflagellates; general characteristics of silicoflagellates; introduction to the systematics of silicoflagellates; distribution of ancient silicoflagellates on the territory of the USSR; evolution of silicoflagellate flora; phylogeny of silicoflagellates; and systematics of the class Silicoflagellatophyeae Borgert.
W71-03198

2J. Erosion and Sedimentation

SLUMP FEATURES ON THE MISSISSIPPI FAN, NORTHEASTERN GULF OF MEXICO,
Naval Oceanographic Office, Washington, D.C.
For primary bibliographic entry see Field 02L.
W71-02760

THE BRAIDED STREAM DEPOSITIONAL ENVIRONMENT: COMPARISON OF THE PLATTE RIVER WITH SOME SILURIAN CLASTIC ROCKS, NORTH-CENTRAL APPALACHIANS,
Illinois Univ., Chicago. Dept. of Geological Sciences.
Norman D. Smith.
Geological Society of America Bulletin, Vol 81, No 10, p 2993-3013, October 1970. 21 p, 24 fig, 3 tab, 49 ref, append.

Descriptors: *Sedimentary structures, *Bed load, *Sediment transport, *Alluvial channels, Colorado, Nebraska, Gravels, Sands, Sand waves, Dunes, Braiding, Meanders, Rivers, Channel morphology, Deposition (Sediments).
Identifiers: *South Platte River, *Platte River, *Braided streams.

Studies of the South Platte and Platte Rivers in Colorado and Nebraska show that braided patterns in streams are created mainly by accretion of longitudinal bars and dissection of transverse bars. Coarse, poorly sorted sediment favors formation of longitudinal bars, and finer grained, better sorted materials form transverse bars. The relative proportion of transverse to longitudinal bars increases downstream with the load increase of sediment of finer sizes downstream. This is accompanied by an increase in the ratio of planar cross-stratification to horizontal stratification and a decrease in cross-channel topographic relief expressed as a bed-relief index. (Knapp-USGS)
W71-02762

SEDIMENTATION ENGINEERING, CHAPTER IV. SEDIMENT SOURCES AND SEDIMENT YIELDS.
American Society of Civil Engineers, New York.

Proc Amer Soc Civ Eng, J Hydraul Div, Vol 96, No HY6, p 1283-1329, June 1970. 47 p, 26 fig, 10 tab, 93 ref, append.

Descriptors: *Sedimentation, Sedimentation rates, Strip mines, Runoff, *Sediment production, *Sediment yield, Sediment transport, Storms, Gully erosion, Channel erosion, Rainfall, *Erosion, Bibliographies, Analytical techniques, Accelerated erosion, Disposition (Sediments), Sheet erosion, Equations, Sediment concentration.
Identifiers: Engineering works.

Methods and procedures for determining erosion rates from waterborne sediments and sediment yield or deposition rates at locations downstream from the erosion source are analyzed. Emphasis is placed on the erosion types and processes that cause the most engineering problems by large sediment quantities or by locally severe damages incurred. Accelerated erosion and deposition rates from the activities of man are of special concern; these derive from sheet erosion processes on tilled lands and from specialized activities such as strip mining, urban development, construction of highways and utilities, and sheet erosion on any portion of the land surface that is denuded or inadequately protected. Erosion and deposition rates caused by channelization or runoff waters in upland gullies and downstream drainageways are also considered. Present bases for estimating the rates on a storm and an average annual basis are given. Has 93 references. (USBR)
W71-02855

THE SAN SIMON WATERSHED; HISTORICAL REVIEW,
Arizona Univ., Tucson. Dept. of Watershed Management.
Gilbert L. Jordan, and Michael L. Maynard.
Progressive Agriculture in Arizona, Vol 22, No 4, p 10-13, July-August 1970. 6 photos.

Descriptors: *Watershed management, *History, *Soil conservation, *Soil erosion, *Revegetation, Sediment transport, Stream erosion, Channeling, Gulley erosion, Sediment control, Reservoir silting, Floodwater, Bank erosion, Sedimentation rates, Dam construction, Rangegrasses, Arizona, Arid lands, Semiarid climates, Brush control, Alluvium, Arroyos, Phreatophytes, Erosion control.
Identifiers: *San Simon Watershed (Arizona).

San Simon Valley, in southeastern Arizona, extends from the Arizona--New Mexico border northwest to Solomon, Arizona, where the San Simon River enters the Gila. This 65-mile long, 25-mile-wide valley covers about one million acres of semi-arid rangelands and watersheds. It varies in elevation from 3000 to 4000 feet. The average annual rainfall is 9.5 inches. This historic valley is a frail watershed, subject to excessive soil erosion and channel development. Shrub control, revegetation and dam construction are practiced to develop the depleted watershed. Preliminary attempts to revegetate the area failed, and sedimentation behind dams is a serious problem. Sediment behind one dam advanced 8 miles upstream from 1953 to 1967. In 1962 the Bureau of Land Management, Safford District, and the Department of Watershed Management, University of Arizona, contracted to research the valley's soil and water problems. Successful seedings have since been accomplished. There are photographs of topography, gulleying, floodwater damage and sediment problems. (Popkin-Arizona)
W71-02874

MORPHOLOGY AND STRUCTURE OF WILMINGTON AND BALTIMORE SUBMARINE CANYONS, EASTERN UNITED STATES,
University Coll. of Swansea (Wales). Dept. of Geology.
Gilbert Kelling, and Daniel J. Stanley.
Journal of Geology, Vol 78, No 6, p 637-660, November 1970. 24 p, 13 fig, 3 tab, 31 ref.

Descriptors: *Valleys, *Sediment transport, *Erosion, *Channel morphology, Drowned (Submerged), Underwater, Coasts, Canyons, Channels, Geomorphology, Sedimentation.
Identifiers: *Submarine canyons, Wilmington canyon, Baltimore canyon.

An investigation of the detailed morphology of Wilmington and Baltimore submarine canyons reveals that their salient features and inferred history are very similar. Both canyons trend predominantly southeastward, but the heads display a north-trending hook termination on the shelf. Abrupt alterations in the axial trend of each canyon occur at roughly equivalent axial distances and are accompanied by sharp changes in axial gradient and in the geometry of the canyon profile. The shorter length, lower axial gradient, and less acute profiles of Baltimore canyon indicate that it is morphologically more mature than Wilmington canyon. Continuous seismic reflection profiles in this region have penetrated more than 1 km of sediment, Tertiary and Quaternary in age, but including reflector zones of probable Upper Cretaceous age near the base. Buried channels occur below the shelf adjacent to the heads of Wilmington and Baltimore canyons and indicate that southeast-trending portions of both canyons were initiated by drainage emanating from the vicinity of Delaware Bay during a late Tertiary lowstand. Originating during the Tertiary epoch as a topographic depression on the upper rise, Baltimore valley has acquired its present form through several cycles of erosion and deposition but is at present inactive. Wilmington valley displays a similar complex history, but the presence of a narrow, active channel within the valley suggests that this feature is currently funneling sediment downslope from the shelf and across the upper rise. (Knapp-USGS)
W71-02911

CLIMATE AND SOILS,
Reading Univ. (England). Dept. of Soil Science.
For primary bibliographic entry see Field 02G.
W71-02970

EXTRACTION AND ANALYSIS OF ORGANOCHLORINE INSECTICIDES FROM LAKE SEDIMENTS,
Wisconsin Univ., Madison. Dept. of Soil Science.
For primary bibliographic entry see Field 05A.
W71-02978

RUNOFF AND EROSION CONTROL BY SEEDED AND NATIVE VEGETATION ON A FOREST BURN: BLACK HILLS, SOUTH DAKOTA,
Forest Service, Fort Collins, Colo. Rocky Mountain Forest and Range Experiment Station.
For primary bibliographic entry see Field 04A.
W71-03131

WIND EROSION EQUATION: COMPUTER SOLUTION AND APPLICATION,
Agricultural Research Service, Manhattan, Kans. Div. of Soil Erosion; and Kansas State Univ., Manhattan. Dept. of Statistics and Computer Science.
E. L. Skidmore, P. S. Fisher, and N. P. Woodruff.
Soil Science Society of America Proceedings, Vol 34, No 6, p 931-935, November-December 1970. 5 p, 6 fig, 1 tab, 4 ref.

Descriptors: *Soil erosion, *Wind erosion, *Computer programs, *Erosion control, Winds, Slopes, Vegetation effects, Climates.
Identifiers: *Wind erosion control.

A wind-erosion equation was programmed for computer solution. The relationships among variables are evaluated by the computer, and the general functional relationship between soil loss and independent variables is solved stepwise to give potential average annual soil loss in tons per acre per annum for specified conditions of erodibility, roughness, climatic factor, equivalent field length, and equivalent vegetative cover. The computer also can solve the equation to determine field conditions necessary to reduce potential erosion to a tolerable amount and can compare the effectiveness of various combinations of erosion-control treatments. (Knapp-USGS)
W71-03140

PARTICLE SIZE SORTING OF PROGLACIAL EOLIAN MATERIALS,
Purdue Univ., Lafayette, Ind. Dept. of Agronomy.
D. P. Franzmeier.
Soil Science Society of America Proceedings, Vol 34, No 6, p 920-924, November-December 1970. 5 p, 6 fig, 2 tab, 14 ref.

Descriptors: *Sediment transport, *Suspended load, *Saltation, *Loess, *Dunes, Silts, Sands, Winds, Particle size, Aeolian soils, Glacial drift, Sedimentation, Erosion, Deposition (Sediments).
Identifiers: *Particle size sorting (Winds), *Outwash.

Bagnold proposed that there is a critical size separating particles moved by saltation from those carried in suspension. This theory was tested in proglacial deposits near the Wabash and White Rivers in Indiana. Here the westerly winds of glacial times piled the sand by saltation into a band of dunes and carried the silt in suspension and deposited it as loess east of the dunes. Soil C horizons were sampled in transects across the dune and loess belts of both areas and were analyzed for particle size using narrow size intervals. In both areas a zone between 40 microns and 80 microns diameter separates dune sand from loess. Between these limits the dune sands and loess are more than 94% exclusive of each other. Glacial till that is representative of the source of outwash, which, in turn, is the source of the oelian deposits, contains much 40 to 80 micron material. This size fraction, however, is practically missing from both the dunes and the loess. Apparently this fraction was selectively removed by wind or by water and deposited elsewhere. (Knapp-USGS)
W71-03147

2K. Chemical Processes

EVALUATION OF EARTHLY MATERIALS FOR USE IN DECONTAMINATION OF WATER,
Auburn Univ., Ala. Water Resources Research Inst.
For primary bibliographic entry see Field 05B.
W71-02752

EXCHANGE OF DIQUAT CATIONS IN SOIL CLAYS, VERMICULITE AND MONTMORILLONITE WITH HOAI INTERLAYERS,
Auburn Univ., Ala. Dept. of Agronomy and Soils.
For primary bibliographic entry see Field 05B.
W71-02754

WATER RESOURCES DATA FOR TEXAS, 1968 - PART 2. WATER QUALITY RECORDS.
Geological Survey, Austin, Tex. Water Resources Div.

Available from District Chief, Water Resources Div, US Geol Survey, Federal Office Bldg, 300 E 8th St, Austin, Tex. 78701. Geological Survey Basic Data Duplicated Report, 1970. 746 p, 3 tab, 17 ref, index.

Descriptors: *Water resources, *Water quality, *Surface waters, *Texas, Chemical analysis, Sediment transport, Sediment load, Water temperature, Rivers, Streams, Streamflow, Flow rates, Chemical analysis, Data collections, Hydrologic data, Sampling.
Identifiers: *Basic data report.

Water quality analyses of samples collected throughout the state of Texas during the 1968 water year (October 1967-September 1968) are tabulated. Samples usually were collected at or near points on streams where gaging stations are maintained by the U. S. Geological Survey for measurement of water discharge. Discharge records for streams in Texas have been released in the report 'Water Resources Data for Texas, 1968, part 1. Surface Water Records.' Most of these records are used in conjunction with the computations of the chemical constituents and sediment loads. Samples were collected daily at 109 stations and periodically at numerous other sites. Miscellaneous sam-

ples were collected to evaluate water quality at locations where water-development projects are likely to be built, and to delineate water-problem areas. At the 10 chemical-quality stations in the Rio Grande basin where samples were collected by the International Boundary Commission and analyzed by the U. S. Department of Agriculture, samples were collected daily at two stations and from 1 to 31 samples were collected each month at eight stations. Water temperatures were measured at most of the water-quality stations. At stations where thermographs are located, the records consist of maximum and minimum temperatures for each day and the monthly averages. Headings for chemical quality tables include sampling location; drainage area; records available; extreme values for dissolved solids, hardness, specific conductance, and water temperatures; and remarks. (Woodard-USGS)
W71-02759

GEOCHEMICAL BALANCE OF A SMALL WATERSHED AND ITS GEOMORPHIC IMPLICATIONS,
Maryland Geological Survey, Baltimore; Vanderbilt Univ., Nashville, Tenn. Dept. of Geology; and Johns Hopkins Univ., Baltimore, Md. Dept. of Earth and Planetary Sciences.
Emery T. Cleaves, Andrew E. Godfrey, and Owen P. Bricker.
Geological Society of America Bulletin, Vol 81, No 10, p 3015-3032, October 1970. 18 p, 7 fig, 9 tab, 17 ref. ACS Grant 665-G2 and NSF Grant GP 2660.

Descriptors: *Geochemistry, *Weathering, *Small watersheds, *Leaching, *Maryland, Erosion, Geomorphology, Prescipitation (Atmospheric), Vegetation effects, Climates, Weather, Solubility, Water chemistry.
Identifiers: *Chemical weathering.

A detailed input-output study of a small forested watershed draining the Wissahickon Formation in the Piedmont of Maryland revealed that chemical solution is five times as effective in removing material as is mechanical erosion. Solution weathering removes 16.9 tons/sq mi/yr of material compared with 3.2 tons/sq mi/yr by mechanical erosion. Plant activity during the growing season increased the concentration of silica, bicarbonate, calcium, and potassium, thus increasing total dissolved solids by one-third. The concentrations of sulfate, potassium, and calcium increases whereas silica and bicarbonate decrease in concentration during a flood cycle. During the first half of a flood cycle, both the flood water and the dissolved solids in it come from an area in and immediately adjacent to the flood plain. Approximately one-half of the erosion of the Pond Branch watershed is caused by chemical solution of the silicate minerals kaolinite, vermiculite, biotite, and oligoclase. (Knapp-USGS)
W71-02761

DISTINGUISHING WINTER FROM SUMMER RECHARGE TO GROUNDWATER IN SOUTHERN ARIZONA BY DEUTERIUM ANALYSIS,
Arizona Univ., Tucson; and Geological Survey, Denver, Colo.
For primary bibliographic entry see Field 02F.
W71-02769

A PRACTICAL GUIDE TO WATER QUALITY STUDIES OF STREAMS,
Federal Water Quality Administration, Cincinnati, Ohio. National Field Investigations Center.
For primary bibliographic entry see Field 02A.
W71-02885

CHEMICAL BEHAVIOR OF MERCURY IN AQUEOUS MEDIA,
Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 05B.
W71-02889

MERCURY CONTENTS OF NATURAL THERMAL AND MINERAL FLUIDS,
Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 05B.
W71-02890

SOURCES AND BEHAVIOR OF MERCURY IN SURFACE WATERS,
Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 05B.
W71-02891

BIOLOGICAL FACTORS IN THE CHEMISTRY OF MERCURY,
Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 05B.
W71-02892

TRITIUM FALLOUT IN THE PACIFIC UNITED STATES,
California Univ., Los Angeles. Dept. of Chemistry.
J. S. Leventhal, and W. F. Libby.
Journal of Geophysical Research, Vol 75, No 36, p 7628-7633, December 20, 1970. 6 p, 2 fig, 9 tab, 12 ref. AFOSR-AF-1255-67.

Descriptors: *Fallout, *Tritium, *Distribution patterns, *United States, Data collections, Meteorological data, Sampling.
Identifiers: *Tritium fallout.

Tritium has been measured since the 1961-1962 nuclear tests to determine fallout patterns. Crater Lake tritium data are used for a model of mixing and fallout. Ocean-atmosphere-continent effects of stratosphere fallout and dilution by ocean water show continental and latitudinal variation. The samples showed both continental and latitudinal effects. As the collection of samples progressed farther inland from the coast, the diluting ocean effect was less important and reevaporation of continental water was more important as reflected in higher tritium concentrations. This increase was also observed at higher latitudes, nearer the latitude of nuclear tests, and also of the lower less stable tropopause. Several ocean samples collected near river outlets showed very large (as much as 20 times) increases of tritium due to rain and runoff as compared with open ocean values. (Knapp-USGS)
W71-02898

A CARBONATE CHEMISTRY PROFILE AT THE 1969 GEOSECS INTERCALIBRATION STATION IN THE EASTERN PACIFIC OCEAN,
Rochester Univ., N.Y. Dept. of Geological Sciences.
Taro Takahashi, R. F. Weiss, Charles H. Culberson, John M. Edmond, and Douglas E. Hammond.
Journal of Geophysical Research, Vol 75, No 36, p 7648-7666, December 20, 1970. 19 p, 4 fig, 7 tab, 22 ref.

Descriptors: *Water chemistry, *Pacific Ocean, *Carbonates, Hydrogen ion concentration, Carbon dioxide, Salinity, Water temperature, Alkalinity, Calibrations, Analytical techniques, Gas chromatography, Electrochemistry.
Identifiers: *Carbonate chemistry.

To compare and evaluate measurements made by the various laboratories participating in the Geochemical Ocean Section Study (Geosecs), four carbonate chemistry parameters, pH, pCO_2, alkalinity, and total dissolved CO_2, as well as temperature and salinity were measured for samples collected at the Geosecs intercalibration station. The alkalinity values measured by the pH method agree with the values measured by the potentiometric acid titration method within 1%, and the total CO_2 values measured by the chromatographic method agree with the values measured by the potentiometric acid titration method within 2%. The observed 3 to 5% difference between the total CO_2 values measured by the Chromatographic and infrared methods is attributed to the biological alteration of the unpoisoned samples used for the infrared methods. When two of the four measured carbonate parameters were used to calculate the remaining two parameters, the calculated values are found to differ systematically from the measured values for those two parameters. Such a discrepancy can be eliminated if a 30% error in the second apparent dissociation constant for carbonic acid is assumed. (Knapp-USGS)
W71-02899

TRITIUM PROFILE AT THE NORTH PACIFIC (1969) GEOSECS INTERCALIBRATION STATION,
Wolfgang Roether, Karl-Otto Munnich, and H. Gote Ostlund.
Journal of Geophysical Research, Vol 75, No 36, p 7672-7675, December 20, 1970. 4 p, 1 fig, 1 tab, 5 ref. Grant GA-1336 NSF.

Descriptors: *Mixing, *Sea water, *Tracers, *Tritium, Fallout, Currents (Water), Distribution patterns, Data collections, Sampling, Water analysis, Diffusion, Turbulence.
Identifiers: Tritium profiles (Pacific Ocean).

A detailed tritium concentration profile at the Geosecs (1969) station in the North Pacific has been measured. From 0 to 150 meters, values are relatively constant at about 23 TU and then decrease rapidly to 0.2 TU at 400 meters and greater depths. The tritium data show that there is a steplike decrease in vertical mixing intensity at a depth of approximately 150 meters. Detailed tritium measurements are of great value in evaluating the vertical mixing properties of the ocean on a time scale of several years. The vertical mixing found in the region between depths of 150 and several hundreds of meters is considerably smaller than many earlier estimates based on other methods. It seems reasonable, however, in light of other experimental and theoretical results. (Knapp-USGS)
W71-02900

TRACE ELEMENT CALIBRATIONS AND PROFILES AT THE GEOSECS TEST STATION IN THE NORTHEAST PACIFIC OCEAN,
Woods Hole Oceanographic Inst., Mass.
Derek W. Spencer, D. E. Robertson, K. K. Turekian, and T. R. Folsom.
Journal of Geophysical Research, Vol 75, No 36, p 7688-7696, December 20, 1970. 9 p, 9 fig, 6 tab, 9 ref.

Descriptors: *Trace elements, *Sea water, *Pacific Ocean, Data collections, Sampling, Surveys, Calibrations, Chemical analysis, Water analysis, Analytical techniques, Profiles.
Identifiers: Sea water analysis.

Four laboratories collaborated on the trace element analysis of sea water samples obtained on the 1969 Geosecs test cruise in the northeast Pacific Ocean. The elements determined were Sr, Cs, Rb, Co, Ni, Sc, Cu, Sb, Zn, Fe, and U. Two or more laboratories reported on Sr, Cs, Zn, Fe, and U. The general agreement was good. Depth variations were noted for some elements. Acidified samples were higher in Fe, Zn, and Co than the unacidified samples. Except for surface iron values, filtering had no effect on concentration. (Knapp-USGS)
W71-02901

IRON REMOVAL USING MAGNESIUM OXIDE,
Illinois Univ., Urbana. Dept. of Civil Engineering.
For primary bibliographic entry see Field 05D.
W71-02904

METHODS OF ANALYZING OILFIELD WATERS: CESIUM AND RUBIDIUM,
Bureau of Mines, Bartlesville, Okla. Bartlesville Petroleum Research Center.
A. Gene Collins.
Bureau of Mines Report of Investigations 6641, 1965. 18 p, 2 fig, 5 tab, 43 ref.

Descriptors: *Geochemistry, *Chemical analysis, *Water analysis, *Cesium, *Trace elements, Oil fields, Flame photometry, Spectrophotometry, Brines, Solvent extractions, Solvents, Water pollution sources, Tracking techniques.
Identifiers: *Rubidium.

Knowledge of the cesium and rubidium content of oilfield waters aids in resolving the origin of waters and petroleum, exploring for petroleum and other valuable minerals, discovering water pollution sources, and augmenting the knowledge of geologic formations. Methods are described to permit the detection of less than 0.01 mg/liter of cesium and/or rubidium in a complex oilfield brine or water. Solvents possessing high-dielectric constants were evaluated for their ability to extract cesium and rubidium tetraphenylboron from oilfield waters and for their flame emission characteristics. Nitroethane was selected and used for the extraction and flame spectrophotometric determinations because it gave the highest sensitivity. Cesium 137 and rubidium 86 were used to determine the extraction efficiencies, which were about 87 percent and 58 percent respectively using a single 10 ml nitroethane extraction from a distilled water matrix. The standard deviation of the determination was 0.0008 mg for cesium and 0.0007 mg for rubidium in the 0.01 mg range. (Knapp-USGS)
W71-02949

TRANSPORT OF SALTS AND WATER ACROSS A CATION EXCHANGER UNDER A GRADIENT OF HYDROSTATIC PRESSURE,
Aberdeen Univ. (Scotland).
For primary bibliographic entry see Field 03A.
W71-02951

SALT CONCENTRATIONS IN SOILS FURROW-IRRIGATED WITH SALINE WATERS,
Texas Agricultural Experiment Station, College Station.
For primary bibliographic entry see Field 02G.
W71-02961

THE UPTAKE OF ZINC BY CHLORELLA (IN GERMAN),
S. Matzku, and E. Broda.
English summary. Planta (Berl), Vol 92, No 1, p 29-40, 1970. 5 fig, 1 tab, 23 ref.

Descriptors: *Chlorella, *Adsorption, *Zinc radioisotopes, Light, Aeration, Calcium.
Identifiers: *Chlorella fusca, Saturation kinetics, Michaelis constant.

Under optimum conditions of light and aeration, labeled zinc is effectively taken up by Chlorella fusca during long periods and the element cannot be completely washed out from tissues. The velocity of uptake depends on the zinc content of the cells, concentration of calcium in the solution, and follows saturation kinetics. The uptake does not influence the efflux of preabsorbed rubidium. Part of the labelled zinc can be slowly removed from tissues with a carrier solution of zinc chloride and calcium chloride, or with EDTA. (Wilde-Wisconsin)
W71-03039

UTILIZATION OF BIOGENIC ELEMENTS BY A PHYTOPLANKTON COMMUNITY DEPENDING ON THEIR CONCENTRATION IN THE AQUATIC ENVIRONMENT AND ILLUMINATION CONDITIONS (IN RUSSIAN),
Moscow State Univ. (USSR).
V. D. Fedorov, T. I. Belaya, and V. N. Maksimov.
English summary. Izvestiya Akademii nauk SSSR, Vol 3, p 398-414, 1970. 4 fig, 5 tab, 12 ref.

Descriptors: *Phytoplankton, *Productivity, *Nutrition, Photosynthesis, Phosphorus, Iron, Light, Nitrates, Chemicals.
Identifiers: Nutrient concentration, Sodium nitrate, Monosodium phosphate, Iron sulfate.

Planned addition of sodium nitrate, monosodium phosphate, and iron sulfate permitted to establish a relationship between the consumption of nutrients and production of phytoplankton at different illumination intensities. Analysis of obtained regression equations indicated that the consumption of biogenic elements per unit of the biomass increases with a higher concentration of nutrients. An increase in the concentration of phosphorus, however, lowered the uptake of nitrogen; a reversed trend was not observed. An increase in the concentration of phosphorus and iron augmented the consumption of both elements. 100% increase in the intensity of light lowered the consumption of all introduced nutrients. (Wilde-Wisconsin)
W71-03053

SIMPLE INSTRUMENTATION FOR MEASURING TEMPERATURE GRADIENTS AT THE SEA-AIR INTERFACE, INCLUDING THE RESULTS OF WINTER 1964/65 MEASUREMENTS,
SACLANT ASW Research Centre, La Spezia (Italy).
For primary bibliographic entry see Field 07B.
W71-03081

NITRATE AND AMMONIUM CONTENTS OF WISCONSIN LIMESTONES,
Wisconsin Univ., Madison. Dept. of Soil Science.
P. M. Chalk, and D. R. Keeney.
Nature, Vol 229, No 5279, p 42, January 1, 1971. 1 p, 1 tab, 5 ref.

Descriptors: *Nitrates, *Ammonium salts, *Limestones, *Wisconsin, *Water pollution sources, Groundwater, Laboratory tests, Methodology, Aquifers.

Nitrate-nitrogen was determined in 210 limestone samples from quarries throughout Wisconsin. Major geological formations sampled were Niagara (Silurian), Galena Black River (Ordovician), Lower Magnesian (Ordovician), and Mendota (Cambrian) dolomites. Determinations were made with the nitrate-selective ion electrode. Nitrate-nitrogen and ammonium-nitrogen also were determined in seventy-four of these samples using the direct steam-distillation method. Close agreement was found between nitrate-nitrogen values determined by the two procedures. All samples contained measurable amounts of these forms of nitrogen, and values as high as 37 ppm (parts per million) nitrate-nitrogen and 18 ppm ammonium-nitrogen were obtained. There seemed to be no relationship between nitrate content and type of limestone. Results indicated that many limestones are a potential source of nitrate to percolate waters and that geological contributions of nitrate should be considered when evaluating sources of nitrate to groundwaters. (Woodard-USGS)
W71-03111

PREPARING POLYWATER AND OTHER ANOMALOUS LIQUIDS,
Worcester Polytechnic Inst., Mass. Dept. of Chemistry.
P. A. Christian, and L. H. Berka.
Chemistry, Vol 44, No 1, p 25-28, January 1971. 4 p, 4 fig, 15 ref.

Descriptors: *Water properties, *Water chemistry, *Water structure, *Water types, *Water of crystallization, Water analysis, Water vapor, Condensation, Methodology, Laboratory tests, Gels.
Identifiers: *Polywater, *Anomalous liquids, Pyrex capillaries, Quartz capillaries.

Several methods for preparing columns of anomalous water in microscopic pyrex of quartz capillaries are reviewed. Basically, these methods involve the condensation of water vapor in freshly drawn microscopic (10-100 micron) capillaries under controlled conditions. Depending upon the relative humidity of the atmosphere to which the capillaries are exposed, these methods may be classified as either saturated or unsaturated. In the saturated method, which is the simpler technique, capillaries are exposed to an atmosphere containing water vapor at saturation pressure for periods ranging from several hours to several weeks. In the unsaturated technique, there are two ways of exposing capillaries to water vapor slightly below the saturation pressure. The first is very similar to the saturated method, except that a concentrated salt solution is substituted for distilled water. The vapor pressure of water in the salt solution is considerably lower than that of distilled water; thus, the relative humidity inside the vessel is only 80-95% instead of 98-100%. Some of the polywater samples have a two-phase structure and appear to consist of a clear and a Vaseline-like, gelatinous phase, whereas most of the other polywater samples appear to have small granular particles dispersed throughout the column. (Woodard-USGS)
W71-03112

EVIDENCE THAT POLYWATER IS A COLLOIDAL SILICATE SOL,
Naval Research Lab., Washington, D.C.
For primary bibliographic entry see Field 01B.
W71-03113

DETERMINATION OF MERCURY IN WATER,
Geological Survey, Denver, Colo.
For primary bibliographic entry see Field 05A.
W71-03114

CARBON DIOXIDE IN THE SURFACE WATER OF THE ICE-COVERED BERING SEA,
Alaska Univ., College. Inst. of Marine Science.
J. J. Kelley, Jr., and D. W. Hood.
Nature, Vol 229, No 5279, p 37-39, January 1, 1971. 3 p, 2 fig, 2 tab, 6 ref.

Descriptors: *Water chemistry, *Carbon dioxide, *Surface waters, *Oceans, *Data collections, *Sea ice, Sea water, On-site investigations, Ships, Atmosphere, Sampling, Analysis, Hydrologic data.
Identifiers: *Bering Sea, *U.S. Coast Guard ice breaker (Northwind).

The distribution of CO2 between the atmosphere and the sea over open leads and polynyi in the ice-covered Bering Sea was measured from the U. S. Coast Guard ice breaker Northwind during February 1970. Measurements were made with an infrared analyzer, MSA LIRA 200. The concentrations (mixing ratio) of CO2 are reported in parts per million by volume dry air. The equilibrium concentration of CO2 in the sea water restricted by leads and polynyi in an ice covered sea showed that the water was supersaturated in CO2 with respect to air and the magnitude of the supersaturation was relatively constant over a wide area of the sea ice pack of the south-eastern Bering Sea. The average concentration difference between CO2 in the sea and air during the cruise was closely comparable with that observed in this particular region of the Bering Sea during the summer when ice free conditions prevailed. (Woodard-USGS)
W71-03115

THE DETERMINATION OF SHORT-CHAIN FATTY ACIDS IN AQUEOUS SOLUTION BY GAS-LIQUID CHROMATOGRAPHY,
National Inst. for Water Research, Pretoria (South Africa).
For primary bibliographic entry see Field 05A.
W71-03118

AUTOMATED ANALYSIS OF AMMONIA IN WATER,
National Inst. for Water Research, Pretoria (South Africa).
For primary bibliographic entry see Field 05A.
W71-03119

SEPARATION OF ADSORBED CATION SPECIES AS WATER FLOWS THROUGH CLAYS,
Agricultural Research Service, Beltsville, Md., Soil Lab.
W. D. Kemper, I. D. Sills, and L. A. G. Aylmore.
Soil Science Society of America Proceedings, Vol 34, No 6, p 946-948, November-December 1970. 3 p, 2 fig, 1 tab, 3 ref.

Descriptors: *Ion exchange, *Reverse osmosis, *Clay minerals, Clays, Ion transport, Membrane processes, Ions, Mineralogy.
Identifiers: *Ion separation.

Theory predicts that adsorbed divalent cations move upstream and monovalent cations move downstream in a mixed ion system, when solutions of low concentration are forced through clay. Data from small size mica support this prediction. (Knapp-USGS)
W71-03143

2L. Estuaries

SLUMP FEATURES ON THE MISSISSIPPI FAN, NORTHEASTERN GULF OF MEXICO,
Naval Oceanographic Office, Washington, D.C.
J. R. Walker, and J. V. Massingill.
Geological Society of America Bulletin, Vol 81, No 10, p 3101-3108, October 1970. 8 p, 10 fig, 2 ref.

Descriptors: *Deltas, *Mississippi River, *Deposition (Sediments), Sedimentary structures, Geomorphology, Mud flows, Sedimentation, Sediments, Mud, Silts, Sands, Continental slope, Marine geology.
Identifiers: *Slumps, *Mississippi Delta, *Mississippi Fan.

During recent geologic time, the Mississippi River system has been the dominant contributor of terrigenous sediment to the northeastern Gulf Basin. A large mass of sediments has been produced on the continental slope seaward of the mouth of this system. This sedimentary feature is the Mississippi Fan. Several crossings of the fan yield seismic records that led to the conclusion that large scale slumps were active on the fan in very recent time. One slump movement originated near the mouth of the Mississippi Trough and moved about 160 nm toward the southeast. A part of this slump flowed to the south and southwest, or a second slump developed at about the same time and flowed in this direction for a distance of about 130 nm. The southeasterly slump is about 70nm in width, and the smaller slump, to the west, is nearly 38 nm wide. The maximum measured vertical distance from the point of origin of these features to the downslope limit is about 4000 ft. (Knapp-USGS)
W71-02760

RESIDENCE TIMES OF WATERS BEHIND BARRIER ISLANDS,
Florida Univ., Gainesville. Water Resources Research Center.
T. Y. Chiw, J. Van de Kreeke, and R. G. Dean.
Available from NTIS as PB-196 628, $3.00 in paper copy, $0.95 in microfiche. Completion Report, Florida Water Resources Research Center, Gainesville, Publication No 11, August 1970. 100 p, 17 fig, 31 ref, 4 append. OWRR Project A-007-FLA (2).

Descriptors: *Estuaries, Mixing, Flushing, *Dispersion, Numerical models, Florida, Lagoons, *Inlets (Waterways), *Tidal waters, Tides, Flow, Discharge (Water), *Convection, Circulation.
Identifiers: Lake Worth (Fla), Sarasota (Fla), Barrier islands, *Residence time (Water), Mass transport, Water exchange, Net flow, Convective transport.

Estuaries separated from the ocean by barrier islands are numerous on the Atlantic and Gulf of Mexico coastlines in general and on the Florida coastline in particular. Attention is focused on the exchange processes of waters behind barrier islands. Part I deals with the non-dispersive aspects as affected by tides and freshwater discharges. A computational procedure is developed with reference to Lake Worth and Sarasota Bay, Florida. The tide-induced net flow, through one or two inlets which can be viewed as a 'mass-transport' effect, is stressed. This net flow can be significant in water exchange considerations and could be enhanced by the proper design of inlets. Field and/or model corroboration of this conclusion is recommended. Part II of the report considers the renewal of estuary waters resulting from dispersive transport in tide-driven flows. Assuming quasi-steady state conditions, dispersion coefficients are presented, based on field measurements in Lake Worth and Sarasota Bay. The measurements are also interpreted in terms of residence times for the northern and southern portions of Lake Worth, Florida.
W71-03007

BACTERIA IN ESTUARINE (BRAS d'OR LAKE) SEDIMENT,
Dalhousie Univ., Halifax (Nova Scotia). Inst. of Oceanography.
E. H. Anthony.
Canadian Journal of Microbiology, Vol 16, No 5, p 373-389, 1970. 6 fig, 7 tab, 20 ref.

Descriptors: *Bacteria, *Estuaries, *Sediments, Salinity, Sampling, Numerical analysis, Population, Filters.
Identifiers: Bras d'Or Lake (Canada), Chromogens, Fresh counts, Frozen counts.

Bacteria numbers in sediments of an estuarine environment (salinity 20-25%) in Cape Breton Island, Nova Scotia, was determined by membrane filter counts from 73 fresh and 67 frozen samples from 20 stations and results compared. Taylor's model (log variance — a .. b log mean) was used to determine dispersion on filters and normalizing transformations in preference to aligning data with Poisson expectation via Fisher's x-square test. Mean with 95% confidence equals 245,000, plus or minus 40,000, colonies/gram dry sediment (transformed — 228,000 plus or minus 20,400) from fresh samples. Variance between replicate filters was negligible. Most remaining variance was between samples; conversion of counts to weight basis introduced negligible variance. Counts from frozen samples were less variable than those from fresh samples. Fresh and frozen counts correlated well after transformation. Freezing confirmed as a method of preserving sediment for bacterial counts. Distribution in sediment of bacteria detected by these counts was slightly overdispersed (aggregated). Chromogenic colonies were prominent in the counted flora and directed attention to the possible role that interaction between organisms plays in counts of this nature, including antibiosis. (Jones-Wisconsin)
W71-03029

THE ROLE OF ESTUARIAN SEDIMENT MICROORGANISMS IN THE UPTAKE OF ORGANIC SOLUTES UNDER AEROBIC CONDITIONS,
North Carolina State Univ., Raleigh. Dept. of Zoology.
Lindsay W. Wood.
Ph D Thesis, Dep of Zoology, North Carolina State University, Raleigh, 1970. 75 p, 63 fig, 14 tab, 71 ref. B-004-NC (2), B-020-NC (1).

Descriptors: *Estuaries, *Sediments, *Microorganisms, *Organic matter, *Kinetics, Solutes, Aerobic conditions, North Carolina, Depth, Seasonal, Enzymes, Carbon radioisotopes, Turnovers, Velocity, Respiration, Sampling, Mathematical studies, Phytoplankton, Primary production, Interfaces, Biomass, Algae, Aquatic plants, Temperature, Ecosystems, Salinity, Organic matter, Benthic fauna, Bacteria, Yeasts, Protozoa.
Identifiers: *Uptake, Pamlico Sound (NC), Glucose, Acetate, Dry weight, Transport constant, Protists, Spirostomum.

A previously used method of measuring uptake of radioisotopes in the water column to determine activity of bacterial populations is modified by dilution with substrate free water, thus slowing reaction, allowing replicate sampling, and produced reasonable filtration rates. Because uptake can be described by Michaelis-Menten kinetics, measurement of maximum velocity, turnover time, and a transport constant is possible on diluted samples. The true velocity, providing actual uptake rate requires a determination of natural substrate concentrations in sediment. Maximum uptake velocity was proportional to microbial biomass in water column. By doubling biomass, maximum velocity should be doubled. Consequently, correcting for amount of dilution produced an estimate of maximum velocity in sediments; however bacterial cell aggregations at high densities might influence results. Turnover times depend not only on uptake velocity, but also on natural substrate concentration. Loss of labeled carbon dioxide in sediments was lower than in water column, perhaps due to fermentative utilization of substrate. Algal blooms and aquatic vascular plant decay appeared to affect sediment microbial activity. The method needs testing under conditions paralleling microbial environments together with determination of forms involved in uptake of labeled compounds and fate of substrate fermentation products. (Jones-Wisconsin)
W71-03043

MALATHION: CHRONIC EFFECTS ON ESTUARINE FISH,
Bureau of Commercial Fisheries, Gulf Breeze, Fla. Biological Lab.
For primary bibliographic entry see Field 05C.
W71-03061

EFFECTS OF PROLONGED EXPOSURE TO SEVIN ON AN ESTUARINE FISH, LEIOSTOMUS XANTHURUS LACEPEDE,
Bureau of Commercial Fisheries, Gulf Breeze, Fla. Biological Lab.
For primary bibliographic entry see Field 05C.
W71-03062

THE ESTUARINE VERSION OF THE COLHEAT DIGITAL SIMULATION MODEL,
Battelle Memorial Inst., Richland, Wash. Pacific Northwest Labs.
For primary bibliographic entry see Field 06A.
W71-03070

MATHEMATICAL MODELING OF GULF COAST ESTUARIES,
Texas A and M Univ., College Station. Dept. of Civil Engineering.
For primary bibliographic entry see Field 05G.
W71-03074

A SUCTION PIPE FOR SAMPLING MIDWATER AND BOTTOM ORGANISMS IN THE SEA,
SACLANT ASW Research Centre, La Spezia (Italy).
For primary bibliographic entry see Field 07B.
W71-03080

APPLICATIONS OF ENVIRONMENTAL SATELLITE DATA TO OCEANOGRAPHY AND HYDROLOGY,
National Environmental Satellite Center, Washington, D.C.
For primary bibliographic entry see Field 07B.
W71-03085

LITTORAL ENVIRONMENT OBSERVATION PROGRAM IN CALIFORNIA, PRELIMINARY REPORT FEBRUARY-DECEMBER 1968,
Army Coastal Engineering Research Center, Washington, D.C.
Andre Szuwalski.

Available from NTIS as AD-704 720, $3.00 in paper copy, $0.95 in microfiche. Miscellaneous Paper No. 2-70, February 1970. 242 p.
Identifiers: *Seacoast, *Ocean currents, *Oceanographic data, Data processing systems, Beaches, Erosion, Tides, Wind, Ocean waves, Transport properties, Protection, Continental shelves, California, *Littoral Zone, Littoral currents, Rip currents, Surf, Beach cusps.

The report describes the Littoral Environment Observation (LEO) Program, and assembles in one paper the data collected under the program from February through December 1968. LEO is a cooperative effort of the State of California and the Corps of Engineers to collect information which will increase understanding of the littoral processes and physical characteristics of the California shore. The littoral variables collected under the LEO program include the following beach characteristics: foreshore slope, width and evaluation of berm, presence of cusps, and samples of the sediments. The beach samples are analyzed for mean and median diameter, standard deviation, skewness, and kurtosis. Sea variables include tide level, wave height, wave period, wave direction, type of breaker, direction and velocity of littoral currents, presence of rip currents, and water temperature. Wind velocity and direction are recorded, and panoramic photographs are obtained. The objective is to establish a bank of repetitive, systematic measurements of meteorological and oceanographic forces affecting the shoreline and the response of the shore to these forces. The data collected are being used as a base to analyze physical characteristics of the shoreline and the littoral processes affecting it.
W71-03088

OIL SLICK MOTION NEAR CHESAPEAKE BAY ENTRANCE,
Virginia Inst. of Marine Science, Gloucester Point.
For primary bibliographic entry see Field 05B.
W71-03123

CENTRAL OREGON COAST, VOLUME I. PHYSICAL CONDITIONS AND PRESENT DEVELOPMENT.
Oregon Univ., Eugene. Bureau of Governmental Research and Service.
For primary bibliographic entry see Field 06B.
W71-03199

CENTRAL OREGON COAST. VOLUME II. ECONOMIC PATTERNS.
Oregon Univ., Eugene. Bureau of Governmental Research and Service.
For primary bibliographic entry see Field 06B.
W71-03200

CENTRAL OREGON COAST, VOLUME III, FOREST PRODUCTS INDUSTRY.
Oregon Univ., Eugene. Bureau of Governmental Research and Service.
For primary bibliographic entry see Field 06B.
W71-03201

CENTRAL OREGON COAST. VOLUME IV. AGRICULTURE.
Oregon Univ., Eugene. Bureau of Governmental Research and Service.
For primary bibliographic entry see Field 06B.
W71-03202

CENTRAL OREGON COAST, VOLUME V. COMMERCIAL FISHING AND FISH PROCESSING.
Oregon Univ., Eugene. Bureau of Governmental Research and Service.
For primary bibliographic entry see Field 06B.
W71-03203

CENTRAL OREGON COAST. VOLUME VI. RECREATION TOURISM.
Oregon Univ., Eugene. Bureau of Governmental Research and Service.
For primary bibliographic entry see Field 06B.
W71-03204

CENTRAL OREGON COAST. VOLUME VII. POPULATION AND HOUSING.
Oregon Univ., Eugene. Bureau of Governmental Research and Service.
For primary bibliographic entry see Field 06B.
W71-03205

CENTRAL OREGON COAST. VOLUME VIII. TRANSPORTATION AND UTILITIES.
Oregon Univ., Eugene. Bureau of Governmental Research and Service.
For primary bibliographic entry see Field 06B.
W71-03206

CENTRAL OREGON COAST. VOLUME IX: DEVELOPMENT PROBLEMS AND POTENTIALS.
Oregon Univ., Eugene. Bureau of Governmental Research and Service.
For primary bibliographic entry see Field 06B.
W71-03207

ESTUARINE CONSERVATION LEGISLATION IN THE STATES (AN EXAMINATION OF SOME EXISTING LEGISLATION AND SOME PROPOSALS),
For primary bibliographic entry see Field 06E.
W71-03298

PROPOSED SYSTEMS OF COASTAL ZONES MANAGEMENT: AN INTERIM ANALYSIS,
Gary H. Knight.
Natural Resources Lawyer, Vol 3, p 599-619, 1970.

Descriptors: *Federal government, *Coasts, *Federal project policy, *Legislation, Population, Community development, Distribution patterns, Growth rates, Legal aspects, Jurisdiction, Administrative agencies, Financing, Cost allocation, Cost sharing.

The high rate of population in the nation's coastal zones has led to a series of studies and recommendations for efficient management of this critical resource area. The report of the Commission on Marine Science, Engineering, and Resources and various Senate and House bills are examined, considering their contrasting proposals for: (1) establishment of state coastal zone authorities to manage development of their respective zones; (2) the proper federal agency to coordinate the zone authorities; (3) sanctions to be used by the federal agency to enforce its policies; (4) policy objectives of the project; (5) requirements for state participation and funding; and (6) problems arising from the current definition of 'coastal zone,' with respect to both seaward and inland boundaries. After discussing the status of the various bills in Congress, the author concludes that the programs proposed are generally sound, but he suggests several areas for improvement. It is recommended that comments upon the various proposals be forwarded to Washington for inclusion in the congressional bills. (Hart-Florida)
W71-03299

A CAPSULE HISTORY AND THE PRESENT STATUS OF THE TIDELANDS CONTROVERSY,
For primary bibliographic entry see Field 06E.
W71-03300

03. WATER SUPPLY AUGMENTATION AND CONSERVATION

3A. Saline Water Conversion

BRINE DISPOSAL POND MANUAL,
Bureau of Reclamation, Denver, Colo. Engineering Research Center.
For primary bibliographic entry see Field 05E.
W71-02950

TRANSPORT OF SALTS AND WATER ACROSS A CATION EXCHANGER UNDER A GRADIENT OF HYDROSTATIC PRESSURE,
Aberdeen Univ. (Scotland).
Patrick Mears, and Terence Foley.
For sale by the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402 Price $1.50. Office of Saline Water Research and Development Progress Report No. 584, December 1970. 175 p. OSW Grant 14-01-0001-638.

Descriptors: *Membranes, *Permselective membranes, Electrodialysis, Osmosis, *Semipermeable membranes, *Ion transport, Ion exchange, Reverse osmosis, Desalination.
Identifiers: *Piezodialysis, *Pressure dialysis.

Each of the membrane models studied has given an estimate of all of the phenomenological coefficients required for predicting the operating characteristics of an electrolytic or piezodialytic desalting process employing ion-exchange membranes. A fundamental discussion of the mechanism of transport and coupling processes in the cation-exchange membrane Zeo-Kurb 315 is given. The work carried out in this program has completed the development of techniques for the characterization of ion-exchange membranes using irreversible thermodynamics. A detailed interrelation of the chemical and physical structures of membranes with their transport properties must however await the determination of complete sets of phenomenological coefficients on a wide variety of well-characterized membranes. (Kindley-Office of Saline Water)
W71-02951

VACUUM FREEZING VAPOR-COMPRESSION PROCESS: 60,000 GPD PILOT PLANT EVALUATION,
Colt Industries, Inc., Beloit, Wis.
J. H. Fraser, and D. K. Emmermann.
For sale by Superintendent of Documents, U.S. Govt. Printing Office, Wash., D.C. Price $1.00. Office of Saline Water Research and Development Progress Report No. 573, July 1970. 108 p, 22 fig, 9 ref. OSW Contract 14-01-0001-532.

Descriptors: *Desalination processes, *Freezing, Pilot plant, Desalination.
Identifiers: *Vacuum freezing, Direct melting.

Colt Industries first began development of the Vacuum-Freezing Vapor Compression (VFVC) desalting process in 1960. Under OSW sponsorship, beginning in 1965, the capacity of its pilot plant was increased from 60,000 to 120,000 gpd and the power consumption reduced from 65 to 45 KWH/1000 gallons. Significant improvements were made by increasing surface area of freezer, increasing the efficiency of the vapor compressor, developing a better method of brine drainage from the wash column, and developing a more efficient method of remaining heat from the process. A direct melting concept in which washing and melting processes were combined in the same chamber was extensively evaluated. However, the results were inconclusive at the pilot plant stage of testing. (Rinne-Office of Saline Water)
W71-02952

INDUSTRIAL BY-PRODUCT RECOVERY BY DESALINATION TECHNIQUES.
Aqua-Chem, Inc., Waukesha, Wis.

For sale by the Superintendent of Documents, US Government Printing Office, Washington, DC 20402. Price: $2.50. Office of Saline Water Research and Development Progress Report No 581, October 1970. 314 p, 12 fig, 33 ref, append. OSW Contract 14-01-0001-2103.

Descriptors: *Desalination, *Waste water treatment, *Waste utilization, *By products, Distillation, Reverse osmosis, Electrodialysis, Industrial water, Costs, *Industrial wastes.
Identifiers: Waste concentration, *Water renovation, *By products recovery.

A study was made of the technical and economic feasibility of using desalination methods and equipment for the recovery of materials from industrial plant waste streams. It was determined that a very substantial market for this equipment exists and that desalination technology can convert many waste disposal problems into paying recovery situations. It was estimated that over one billion dollars in desalination equipment could be utilized in various waste recovery and processing operations. The most promising industries are: SIC 26 - Pulp and Paper, SIC 202 - Cheese and Dairy, SIC 3312 - Iron and Steel, SIC 347 - Plating and Metal Finishing, - Nuclear Power Plants, - Acid Mine Drainage. (Powell-Office of Saline Water)
W71-03004

REVERSE OSMOSIS FIELD TESTING ON ACID MINE WATERS AT NORTON, WEST VIRGINIA,
Gulf General Atomic, Inc., San Diego, Calif.
For primary bibliographic entry see Field 05D.
W71-03005

DEVELOPMENT OF TUBULAR REVERSE OSMOSIS MODULE ASSEMBLY TECHNIQUES,
Aerojet-General Corp., El Monte, Calif.
G. A. Fluke.
For sale by the Superintendent of Documents, US Government Printing Office, Washington, DC 20402. Price: $1.00. Office of Saline Water Research and Development Progress Report 582, August 1970. 78 p, 7 tab, 45 fig. OSW Contract 14-01-0001-2163.

Descriptors: *Desalination, *Reverse osmosis, *Membranes, *Membrane processes, Osmosis, Waste water treatment, Design, *Tubes, Porosity.

The development of the process and equipment for the continuous production of porous wall reverse osmosis tubes lined with membrane material deposited by extrusion warranted the development of a chilled water membrane gellation system, of a reliable and accurate tube length sizing apparatus, of tooling and procedures for rapid installation of tube end fittings, of a heat treat fixture permitting simultaneous heat treatment of several reverse osmosis tubes, of low- and high-pressure tube leak check and reverse osmosis test apparatus, of procedures for holding, alignment and positioning of individual tube headers, and of techniques for 'in-process' handling and storage of tubes. The five tasks performed were: to operate the production line for characterizing functions, control points of the process, to determine the desalination performance of the tubular reverse osmosis elements, to develop individual return bend shaped headers made from fiberglass reinforced plastic material, to establish quality assurance procedures and determine process reliability, and to optimize the structure of the fiberglass filament/resin composite material of the porous reverse osmosis support tube. (Mattson-Office of Saline Water)
W71-03006

SYSTEMS ANALYSIS OF BRINE DISPOSAL FROM REVERSE OSMOSIS PLANTS,
Dow Chemical Co., Midland, Mich.
For primary bibliographic entry see Field 05E.
W71-03216

3B. Water Yield Improvement

EXPERIMENTAL INVESTIGATIONS AND COMPUTATION OF EVAPORATION FROM WATER SURFACE,
State Hydrological Inst., Leningrad (USSR).
For primary bibliographic entry see Field 02D.
W71-02779

WATER UTILIZATION ASPECTS OF WEATHER MODIFICATION AS APPLIED TO KANSAS,
Kansas Water Resources Research Inst., Manhattan.
Robert L. Smith.
Available from NTIS as PB-196 310, $3.00 in paper copy, $0.95 in microfiche. Project Completion Report, November 1970. 64 p, 7 tab, 12 fig, 10 ref, 2 append. OWRR Project A-023-KAN (1).

Descriptors: *Hydrologic cycle, *Weather modification, *Water utilization, Rainfall, Runoff, Rainfall-runoff relationships, *Streamflow, Precipitation (Atmospheric), Kansas.
Identifiers: *Precipitation augmentation, Reservoir regulation.

A digital model of the land phase of the hydrologic cycle is utilized to determine the probable response of Kansas streams to various patterns of rainfall augmentation. Seven test basins, representing a broad range of climatic conditions, are analyzed. Comparative analysis of the results of simulations performed for historic and augmented patterns indicates runoff response would be most sensitive to changes in the precipitation pattern. In Kansas, the percentage increase in average streamflow will be approximately four times the percentage increase in average precipitation--assuming uniform aggmentation of the historic pattern. This estimated increase in average yield has to be discounted by about one half when allowance is made for practical operating constraints. The effects of randomness in the generation of augmented precipitation are explored in a limited way. Preliminary findings indicate random generation does not pose significant problems in appraising potential gains in stream yield. Justification for a statewide program of precipitation augmentation in Kansas would have to be highly dependent on benefits to dry land agriculture. The potential importance to other beneficial uses of water will, for the most part, be limited by the opportunity for reservoir regulation of the augmented flows. The percentage gain in gross sustaining yield of reservoirs will approximate the percentage gain in precipitation. An empirical relationship for determining the percentage gain in average runoff to be realized under conditions of uniformly augmented precipitation is presented. Data presented in the report suggest this relationship may be applicable to many areas of the nation.
W71-02827

STRUCTURE AND FUNCTION OF THE KIDNEY AND THE WATER BALANCE OF DESERT BATS,
San Diego State Coll., Calif. Dept. of Zoology.
For primary bibliographic entry see Field 02I.
W71-02866

REMOVAL AND INHIBITION OF CALCIUM SULFATE SCALE IN WATER FLOOD PROJECTS,
Dowell, Inc., Tulsa, Okla.
C. F. Smith, T. J. Nolan, III, and P. L. Crenshaw.
Journal of Petroleum Technology, Vol 22, No 11, p 1249-1256, November 1968. 21 ref.

Descriptors: *Scale prevention, *Descaling, Scaling, Calcium sulfate, Flooding, Oil well, Injection.
Identifiers: *Scale-removal agents, *Potential-scale inhibitors, Producing oil wells, Polyphosphate, Calcium orthophosphate, Cost-to-performance.

The problem of preventing calcium sulfate scale deposition has become increasingly important in the last few years due to the increasing use of waterflood as a means of secondary recovery. Many methods have been proposed for removing or preventing scale deposition. A few chemicals and treatment methods have been effective, but there are many ineffective scale-removal agents and inhibitors still on the market today. This paper describes the results of a laboratory testing program that evaluated potential-scale inhibitors and scale-removal agents. The paper also describes a field testing program in which various removal methods and inhibitor placement techniques were evaluated in 19 wells, and it compares field and laboratory results. (Campbell-NWWA)
W71-02986

WHEN NOT TO ACIDIZE,
Illinois State Water Survey, Urbana.
W. H. Walker.
Groundwater, Vol 5, No 2, p 36-40, April 1967. 2 tab, 4 fig, 4 ref.

Descriptors: *Acids, *Water wells, Illinois, Aquifer characteristics, Testing, Hydraulics.
Identifiers: *Acidizing, Water well development.

Controlled step and constant-rate pumping tests used by the Illinois State Water Survey to determine well efficiencies and hydraulic characteristics of aquifers showed that acidizing water wells to increase yield proved to be uneconomical method of well development or rehabilitation in some cases where aquifer permeability was low and normal operating head great, in wells affected by methane gas or where practical sustained yield of aquifer had been exceeded. Controlled pumping tests before, during and after development are necessary to accurately evaluate effectiveness of rehabilitation methods employed. Geologic definition of aquifers and records of pumpage and water level information are invaluable aids. (Campbell-NWWA)
W71-02989

EFFECT OF PRESSURE DRAWDOWN ON CLEAN-UP OF CLAY-OR SILT-BLOCKED SANDSTONE,
Union Oil Co. of California, Brea.
R. F. Krueger, L. C. Vogel, and P. W. Fischer.
Journal of Petroleum Technology, Vol 19, No 3, p 397-403, March 1967. 13 ref, 6 fig.

Descriptors: *Oil wells, *Aquifers, *Permeability, Drilling fluids.
Identifiers: *Temporary permeability reduction, Permeability damage repair, Backflush treatment.

Laboratory experiments have shown that restriction of oil flow rates during clean-up of water sensitive sandstone invaded with fresh water or filtrate from fresh water-base drilling fluid can materially reduce the amount of permeability damage. High rate clean-up of similar sandstone cores resulted in significantly higher damage. Attempts to repair permeability damage in cores through use of an oil backflush followed by low-rate reverse oil flow were only partially successful. Clean-up methods were usually ineffective for removing permeability damage in the Berea Sandstone. Clean-up of temporary permeability damage in clastic aquifer supplying domestic water supplies can be done via similar reasoning. (Cambell-NWWA)
W71-02992

DON'T UNDERESTIMATE ROLE OF AEROBIC BACTERIA,
G. A. Trautenberg.
The Oil and Gas Journal, Vol 63, No 1, p 85-87, January 4, 1965.

Descriptors: *Bacteria, *Sulphur bacteria, *Aerobic bacteria, Anaerobic bacteria, Ferrobacillus, Iron bacteria, Pseudomonas, Corrosion, Waterflood, Water chemistry, Chemical analysis, Oil industry, California.
Identifiers: *Sulfate-reducing bacteria, *Desulfovibrio, Slime-forming bacteria, Bacillus.

In examining water sample data from a southern California produced-water injection system, a close correlation between the aerobic bacterial counts and the sulfate-reducing bacteria counts was observed. The biocide treatment previously in use was intended to be specific for sulfate-reducing bacteria. The biocide had little effect against the aerobic population and consequently its activity against the sulfate-reducers was negligible. In contract, bacterial counts from the same sampling points being treated with the same level of a different biocide were reduced significantly. The aerobic bacteria isolated from this system were species of Flavobacterium, Alcaligenes, Proteus, and Bacillus. (Campbell-NWWA)
W71-02996

MATRIX ACIDIZING CORRECTS FORMATION DAMAGE IN SANDSTONES,
Dow Chemical Co., New Orleans, La.
W. M. Ross, N. O. Pierson, and A. W. Coulter.
Petroleum Engineer, Vol 35, No 12, p 64-69, November 1963. 1 tab, 4 fig, 3 ref.

Descriptors: *Acids, *Oil wells, *Water wells, Louisiana, Testing, Aquifer characteristics, Hydraulics, Drilling, Oil industry, Drilling fluids.
Identifiers: *Acidizing, *Water well development, *Formation damage matrix acidizing, Mud acid treatments, Granular synthetic polymer, Hydraulic acid fracturing, 'Skin effect'.

Matrix acidizing is a relatively new, but field-proven, technique to correct producing formation damage incurred while drilling or cementing sandstones. It is a result of two significant modifications in conventional mud acid treatments to overcome 'skin effects' around well bore. A granular synthetic polymer is discussed which swells upon contact with acid and serves as an effective fluid loss control additive. Another principal change in mud acidizing is in the application of controlled injection pressures. Using this approach has a reported success ratio of 78% in over 100 wells treated. (Campbell-NWWA)
W71-03000

CLOUDS AND PRECIPITATION IN THE TEXAS HIGH PLAINS,
Texas Tech Univ., Lubbock. Dept. of Geosciences; and Texas Univ., Austin. Atmospheric Science Group.
For primary bibliographic entry see Field 02B.
W71-03128

SOIL WATER EVAPORATION: FIRST STAGE DRYING AS INFLUENCED BY SURFACE RESIDUE AND EVAPORATION POTENTIAL,
Agricultural Research Service, Mandan, N. Dak. Soil Water Conservation Research Div.
For primary bibliographic entry see Field 02D.
W71-03141

3C. Use of Water of Impaired Quality

THE TWICE-USED WATER,
For primary bibliographic entry see Field 02F.
W71-02959

SALT CONCENTRATIONS IN SOILS FURROW-IRRIGATED WITH SALINE WATERS,
Texas Agricultural Experiment Station, College Station.
For primary bibliographic entry see Field 02G.
W71-02961

WATER, SOIL, AND CROP MANAGEMENT PRINCIPLES FOR THE CONTROL OF SALTS,
Arizona Univ., Tucson. Dept. of Agricultural Chemistry and Soils.
For primary bibliographic entry see Field 02G.
W71-02977

3D. Conservation in Domestic and Municipal Use

LAWN WATERING NEED NOT BE WASTEFUL,
Agricultural Research Service, Phoenix, Ariz. Water Conservation Lab.
For primary bibliographic entry see Field 02G.
W71-02976

BOARD OF SUP'RS V WATER POWER AND CONTROL COMM'N (REVIEW OF ORDER AUTHORIZING NEW MUNICIPAL WATER SUPPLY).
For primary bibliographic entry see Field 06E.
W71-03249

3E. Conservation in Industry

INDUSTRIAL BY-PRODUCT RECOVERY BY DESALINATION TECHNIQUES.
Aqua-Chem, Inc., Waukesha, Wis.
For primary bibliographic entry see Field 03A.
W71-03004

A CRITIQUE OF FEDERAL WATER RESOURCES POLICIES: HYDROELECTRIC POWER VERSUS WILDERNESS WATERWAY ON THE UPPER MISSOURI RIVER,
Cornell Univ., Ithaca, N.Y.
For primary bibliographic entry see Field 06B.
W71-03016

3F. Conservation in Agriculture

THE IMPORTANCE OF RAINFALL AND SOIL MOISTURE IN THE AGRICULTURAL DEVELOPMENT OF THE CLOSED FOREST ZONE OF GHANA,
G. Benneh.
In: Symposium on World Water Balance, Vol 2, International Association of Scientific Hydrology Publication No 93, p 467-478, July 1970. 12 p, 8 fig, 9 ref.

Descriptors: *Water balance, *Agriculture, *Forest soils, Foreign projects, Hydrologic cycle, Hydrologic budget, Synoptic analysis, Meteorology, Climatology, Precipitation (Atmospheric), Runoff, Vegetation, Forests, Soil moisture, Hydrologic data, International Hydrologic Decade.
Identifiers: *Ghana.

The importance of rainfall and soil moisture in the agricultural development of the forest region of Ghana is discussed. Lack of water is not often regarded as one of the agricultural problems there because of the high mean annual rainfall figures. The distribution of rainfall in time and space is examined in an attempt to underline the detrimental aspects of the rainfall conditions. The soil moisture of the region is calculated and its relevance to agricultural practice is discussed. Graphs comparing the mean monthly water need and the average monthly rainfall of selected stations in the region are included. (Woodard-USGS)
W71-02794

A SHORT STUDY ON CONSUMPTIVE USE AND THE DATA REQUIRED IN IRAN,
Iran Plan Organization, Tehran. Water Planning Group.
M. Vahidi, and Gh. Ghodratnama.
In: Proceedings of Central Treaty Organization Seminar on Evaluation of Water Resources With Scarce Data, March 4-8, 1969, Tehran, Iran, p 421-437, January 1970. 17 p, 6 tab.

Descriptors: *Consumptive use, *Water, *Crops, *Foreign projects, Water resources, Water quality, Hydrologic data, Meteorological data, Plants, Leaves, Seasonal, Solar radiation, Temperature, Humidity, Winds, Equations.
Identifiers: *Iran, *Scarce data, Tables.

Various direct and indirect methods of determining water requirements for crops are presented that are relevant to soil, climatic, and hydrologic conditions in Iran. Full knowledge of the consumptive use of any crop, from time of seeding until harvest is necessary for the profitable irrigation of that crop. Once the consumptive use of the crops of an area is known, the acreage which can be irrigated by a given source of water may be estimated. Recently, a law to nationalize water resources was passed by the Iranian Parliament. A full knowledge of the consumptive use of crops is necessary to carry out this law, and to allocate water rights to each farmer. Factors involved include irrigation practices, length of growing season, precipitation, water at the plant's disposal, temperature, humidity of the air, wind movement, intensity and duration of sunlight, stage of development of the plant, type of foliage, and nature of the leaves. Grain, vegetable, melon, orchard, vineyard and other crop types are included in the study. (Woodard-USGS)
W71-02803

KHUZESTAN WATER RESOURCES APPRAISAL,
Khuzestan Water and Power Authority, Tehran (Iran).
For primary bibliographic entry see Field 04A.
W71-02808

LAND TREATMENT IN AGRICULTURAL WATERSHED HYDROLOGY RESEARCH,
Agricultural Research Service, Beltsville, Md. Hydrograph Lab.
For primary bibliographic entry see Field 04C.
W71-02812

KHAIRPUR TUBEWELL PROJECT,
West Pakistan Water and Power Development Authority, Lahore.
For primary bibliographic entry see Field 02G.
W71-02816

EXPORT OF MISSISSIPPI RIVER WATER TO TEXAS AND NEW MEXICO,
Bureau of Reclamation, Austin, Tex.
For primary bibliographic entry see Field 06B.
W71-02852

PLAINS PRICKLYPEAR: RELATION TO GRAZING INTENSITY AND BLUE GRAMA YIELD ON CENTRAL GREAT PLAINS,
Agricultural Research Service, Fort Collins, Colo. Crops Research Div.
R. E. Bement.
Central Plains Experimental Range, Crops Research Division, Agricultural Research Station, U.S.D.A. and the Colorado Agricultural Experiment Station, Scientific Paper No. 1197. Journal of Range Management, Vol 21, No 2, p 83-85, March 1968. 1 fig, 2 tab, 7 ref.

Descriptors: *Cacti, *Grama grasses, *Great Plains, *Range management, *Grazing, On-site investigations, Precipitation (Atmospheric), Semiarid climates, Microenvironment, Cattle, Ecology, Insects, Forage grasses, Terrestrial habitats, Mode of action, Environmental effects, Grasslands, Xerophytes, Colorado, Loam, Variability, Range grasses, Pasture management, Crop production.
Identifiers: *Pricklypear, Plots.

Extensive infestation of Central Great Plains rangelands by pricklypear (Opuntia polyacantha Haw.) has often been considered an effect of heavy livestock grazing. Three upland-grama range pastures were grazed, respectively, at light, moderate and heavy intensities (1.79, 3.13 and 4.11 acres/yearling heifer per month) from 1940-1964. Records were kept of annual precipitation and changes in pricklypear cover as a percentage of initial cover in 1940. The cover on all pasture in-

creased over 100% by 1964, with the greatest increase occurring on the light-use pasture and the least on the heaviest pasture. Cover percentages never exceeded 2.4% and 85% of the variation was associated with yearly precipitation changes. Variations in pricklypear abundance seem to be due to soil conditions in association with climatic and biotic factors. Changes in grazing intensity cannot therefore be depended upon as pricklypear management practices. From 1960-1965, 3 sets of adjacent paired lots on Ascalon and Shingle soils were assayed for blue-grama production in which the pricklypear of one member of each pair were removed. The mean yield from the control plots was not significantly different from the experimental plots. (Casey-Arizona)
W71-02860

FORAGE POTENTIAL OF IRRIGATED BLUE GRAMA WITH NITROGEN FERTILIZATION,
Southwestern Great Plains Research Center, Bushland, Tex.
For primary bibliographic entry see Field 02G.
W71-02861

THE CIMARRON NATIONAL GRASSLAND: A STUDY IN LAND USE ADJUSTMENT,
Northern Illinois Univ., De Kalb. Dept. of Geography.
B. Ross Guest.
Journal of Range Management, Vol 21, No 3, p 167-170, May 1968. 3 fig, 2 tab, 5 ref.

Descriptors: *Habitat improvement, *Semiarid climates, *Range grasses, *Land management, *Land use, Productivity, Range management, Wildlife management, Recreation facilities, Economic impact, Economic justification, Planning, Food and cover crops, Wildlife habitat, Kansas, Great Plains, Forage grasses, Ecosystems, Water conservation, Grazing, Rainfall, Loam, Land reclamation, Revegetation, Wind erosion, Soil erosion, Erosion control, Federal government, Education, Livestock, Multiple purpose projects.
Identifiers: *Cimarron National Grassland, *Cimarron River, National Grasslands, Submarginal land.

In 1934, the U.S. Department of Agriculture initiated a program of submarginal farmland and rangeland purchases. These lands, mostly in plains states were transferred to the Forest Service for permanent retention and management and became the National Grasslands system. The Cimarron National Grassland is located in the Cimarron River Valley of semiarid southwestern Kansas. When originally purchased in the 1930's, these lands had suffered heavily from wind and water erosion due to agricultural mismanagement. Most of the plant cover on the rangeland had been destroyed either by overgrazing or dust deposition. Where possible, the land was seeded to sorghum and broom corn, and by 1943 a number of forage grasses had become well enough established to justify grazing. Currently, the area is grazed by about 3500 head of cattle yielding a $15,000/year income. Additionally, wildlife habitats and picnicking areas have been developed to the extent that hunting and recreation have become major usages of the Grassland. It is felt that intangible returns such as educational and recreational values as well as tangible returns such as grazing fees which are redistributed to the county, have proven the utility of government management of marginal lands. (Casey-Arizona)
W71-02862

A SENSITIVE CUP-TYPE ANEMOMETER,
Washington Univ., Seattle.
For primary bibliographic entry see Field 07B.
W71-02864

ALFALFA FOR FORAGE PRODUCTION IN ARIZONA,
Arizona Agricultural Experiment Station, Tucson.
For primary bibliographic entry see Field 02G.
W71-02868

IRRIGATION PRACTICES AND COSTS IN NORTH DAKOTA,
North Dakota State Univ., Fargo. Dept. of Agricultural Economics.
Wallace McMartin, and Ronald O. Bergan.
North Dakota State University, Fargo, Agricultural Experiment Station, Bulletin No 474, March 1968. 48 p, 30 tab, 13 fig, 3 ref.

Descriptors: *Irrigation operation and maintenance, *Irrigation systems, *Cost comparisons, *Evaluation, *North Dakota, Sprinkler irrigation, Irrigation water, Application methods, Surface irrigation, Distribution systems, Irrigated land, Soil moisture, Economic efficiency, Data collections, Pipes, Return (Monetary), Crop production, Farm equipment, Land use, Water requirements, Semiarid climates, Labor, Soil texture, Surveys.
Identifiers: *Mechanical sprinklers, *Self-propelled systems, Hand-move sprinklers, Gated pipe, Tow-line system, Boom system, Wheel-move system.

Irrigation is developed in North Dakota to stabilize the feed supply for existing livestock. This study forms a basis for an economic evaluation of several types of irrigation systems with respect to crop requirements and descriptive information on operating characteristics. Mechanical sprinklers (two-line, boom, wheel-move, self-propelled), hand-moved sprinklers, gated pipe, and conventional surface irrigation systems are evaluated. Eighty farmers' interviews provided the data. Mechanically-moved systems used well water, while other systems used surface water. Irrigation water is used on one or two crops, usually alfalfa and corn silage, or wheat and corn grains. Beef cattle and large acreages of dry cropland were produced. The average investment for self-propelled, two-line, wheel-move and boom systems were $25,452, $13,796, $13,149 and $9,266 per farm. Pipe and sprinkler equipment were large investments for sprinkler systems. Land leveling was the major cost in surface systems. Sprinkler system costs varied from $2.28 per acre for booms to $5.98 per acre for self-propelled systems, though self-propelled systems have low labor costs. Other costs include field labor, fertilizer, seed and spray, and machine costs. Soil-moisture detection methods are also discussed. Tables and figures describe irrigation systems, costs, locations, use, frequency, crops, mechanical features, cultural practices and soil textures. (Popkin-Arizona)
W71-02870

BARLEY--DATES AND RATES OF PLANTING,
Arizona Agricultural Experiment Station, Tucson.
For primary bibliographic entry see Field 02I.
W71-02872

EFFICIENT LETTUCE PRODUCTION DEMANDS CRITICAL FERTILIZER MANAGEMENT,
Arizona Agricultural Experiment Station, Tucson.
B. R. Gardner, and W. D. Pew.
Progressive Agriculture in Arizona, Vol 22, No 4, p 8-9, July-August 1970.

Descriptors: *Fertilizers, *Lettuce, *Cultural control, *Nitrogen, *Arizona, Arid lands, Plant growth regulators, Soil-water-plant relationships, Temperature, Color, Irrigation practices, Leaching, Crop production, Planting management, Weight, Nitrates, Growth rates, Nutrients.
Identifiers: *Nitrogen deficiency, *Nitrogen fertilization.

Efficient production of quality head lettuce results from the proper management of many cultural practices. Nitrogen fertilization is a practice that has a remarkable effect on lettuce growth, over which the grower has control. More fertilizer is applied to lettuce in Arizona than any other vegetable crop. An understanding of the growth pattern of the lettuce plant and ways in which nitrogen fertilizer affects this growth is evaluated through a 5-year plant tissue analysis program of the University of Arizona and the Bruce Church Company of Yuma, Arizona. Temperature has a marked effect on lettuce growth rate. About 80 percent of the total lettuce dry weight is produced during the heading period, where 80 percent of the nitrogen is applied. Nitrogen fertilizer applied in the nitrate form at planting time is extremely susceptible to loss by irrigation leaching. The most efficient program includes smaller fertilizer applications during vegetative growth. Nitrogen deficiency has detrimental effects on color and ribbiness. Incidence of pink rib, rib discoloration, rust spotting, slime mold and pith condition are not associated with nitrogen supply or source. There is a photograph showing the effects of nitrogen on lettuce heads. (Popkin-Arizona)
W71-02873

EVALUATION OF ACARICIDES FOR CONTROL OF THE STRAWBERRY SPIDER MITE ON COTTON AND ALFALFA,
Arizona Univ., Tucson. Agricultural Extension Service.
T. F. Watson, D. G. Fullerton, Leon Moore, D. M. Tuttle, and James Hazlitt.
Progressive Agriculture in Arizona, Vol 22, No 4, p 14-16, July-August 1970. 2 tab, 2 fig.

Descriptors: *Acaricides, *Pest control, *Mites, *Cotton, *Alfalfa, Arizona, Arid lands, Rates of application, On-site tests, Treatment, Growth stages, Insecticides, Eggs, Immature growth stage, Mature growth stage.
Identifiers: *Strawberry spider mite, Azodrin, Acaralate, Chlorobenzilate, G.S. 19851, Galecron.

Small-plot field tests were conducted at Parker, Arizona, to evaluate effectiveness of several acaricides against the strawberry spider mite, Tetranychus turkestani U. and N., on cotton and alfalfa. Populations were high enough by early May so that leaf damage was evident. This research was to obtain information relative to control of the mite on seedling cotton. Azodrin, Acaralate, Chlorobenzilate, G.S. 19851, and Galecron reduced the egg, immature and adult, stages by 90 to 100 per cent in the 7-day post-treatment counts. Alfalfa experiment results generally agree with those obtained on cotton. Azodrin, Acaralate, Chlorobenzilate and Galecron gave the most satisfactory spider mite control for both cotton and alfalfa. Tables show influence of 12 acaricides on mite populations on cotton and alfalfa for 1969 tests. Figures show an arbitrary classification of several acaricides relative to their mite-control effectiveness on cotton and alfalfa. (Popkin-Arizona)
W71-02875

THE IMPACT OF DIFFERENT LEVELS OF WATER DEVELOPMENT ON TEXAS AGRICULTURE,
Texas Agricultural Experiment Station, College Station.
Fred A. Schmer, Warren L. Trock, and Glen L. Wistrand.
Texas A and M University, Texas Agricultural Experiment Station, MP-911, March 1969. 42 p, 40 tab, 2 fig, 8 ref. OWRR Project A-001-TEX, B-005-TEX.

Descriptors: *Economic impact, *Water resources development, *Agriculture, *Evaluation, *Texas, Water resources, Water requirements, Water demand, Resource allocation, Social aspects, Monetary benefits, Water supply, Crop production, Water shortage, Consumptive use, Irrigation practices, Arid lands, Resource development, Planning, Data collections, Model studies, Irrigated land, Forecasting, Economic prediction, Constraints, Dry farming, Land development.
Identifiers: *Commodity requirements, *Resource availability, *Agricultural changes, Economic models, Economic limitation, Reduction, Commodity output.

Present and future agricultural production in Texas is discussed in this report, where normalized 1964 data (resource availability, agricultural yield production and commodity requirements) are projected to 2020. Four models of irrigated acres and future trends, considering resource use and commodity output, are developed and analyzed. The models vary from assuming unlimited water supplies, economic limitations on irrigated production, realistic resource analysis and projected resource development. This study estimates the impact of water resources development on the $6.3 billion agricultural industry. Water, required in hugh quantities for agriculture, is critical to the economy. Approximately 16 million acre-feet of water for municipal, industrial, agricultural and mining purposes was used in 1965. Eighty percent of this water was used on irrigated crops worth $675 million. Irrigated crop production was the basic economy in some areas. At existing cost, there is the prospect of water shortages and reduction in agricultural production. If costs are not reduced, or additional water supplies are not developed, areas suffering water supply declines will suffer economic and social loss. Water planning, present and future agriculture, markets and resources, changes in agriculture and the four models are analyzed. Forty tables show current and projected resources and status of agriculture using the four models. (Popkin-Arizona)
W71-02876

A SOIL WATER MODEL FOR TWO CONTRASTING TILLAGE SYSTEMS,
Virginia Polytechnic Inst., Blacksburg. Water Resources Research Center.
For primary bibliographic entry see Field 02G.
W71-02883

METHODS FOR THE STUDY OF WATER BALANCE OF IRRIGATED LANDS AND IRRIGATION SYSTEMS,
State Hydrological Inst., Leningrad (USSR).
S. I. Kharchenko, and D. M. Katz.
In: Symposium on World Water Balance, Vol 2, International Association of Scientific Hydrology Publication No 93, p 452-458, July 1970. 7 p, 1 tab, 6 ref.

Descriptors: *Water balance, *Irrigated land, *Methodology, Hydrologic cycle, Hydrologic budget, Synoptic analysis, Surface waters, Groundwater, Hydrologic data, Climatology, Meteorology, Precipitation (Atmospheric), Vegetation, Soil moisture, Evpotranspiration, Water table, Salinity, Equations, International Hydrological Decade.
Identifiers: USSR.

Methods developed for water balance studies on reclaimed irrigated lands in the USSR are discussed. A variety of physiographical conditions contributed to the development of different approaches to the methods for water balance investigations and computation. Relations between pedological, chemical, hydrogeological, physiological as well as meteorological and energy processes taking place in the soil-water-plant-atmosphere system are important factors. On the basis of the established relations it becomes possible first to evaluate and then to forecast such processes as secondary salinization, swamping, etc. and also to project more effective engineering measures of prevention and control of these phenomena. A brief account of methods for determination of the components of equations used in the USSR is given. (Woodard-USGS)
W71-02910

IRRIGATION: WHEN-HOW MUCH-HOW,
Arizona Univ., Tucson. Cooperative Extension Service.
For primary bibliographic entry see Field 02G.
W71-02958

ARIZONA AGRICULTURE 1970.
Arizona Univ., Tucson. Dept. of Agricultural Economics.

University of Arizona, Cooperative Extension Service and Agricultural Experiment Station, Bulletin A-70, April 1970. 32 p, 16 tab, 3 fig, 19 ref.

Descriptors: *Arizona, *Costs, *Agriculture, *Income, *Crop production, Water resources, Groundwater, Surface runoff, Surface waters, Prices, Programs, Resource development, Labor, Credit, Field crops, Citrus fruits, Vegetable crops, Melons, Livestock, Arid lands, Cotton, Grains (Crops), Pumped storage, Withdrawal, Water levels, Economic impact, Rural areas, Fruit crops, Poultry.
Identifiers: *Agricultural policy, *International trade programs.

This 40th annual issue discusses costs, income, and production in Arizona agriculture. There are sections on agricultural prices and policy, commodity programs, resource use, economic development, water, labor, agricultural credit, international trade programs, field crops, citrus, grapes, vegetables, melons, livestock and livestock products, and principal Arizona crops in 1969. Arizona's agriculture depends largely on water management. Total surface water diversions and groundwater pumpage during the 1968 water year was 7,799,000 acre/feet, a near record high. About 3,350,000 acre/feet, a record high, was diverted from streams. Groundwater pumpage was about 4,449,000 acre/feet. The decline in statewide water pumped was a result of declines in the Salt River (500,000 acre/feet) and Santa Cruz River Valleys (200,000 acre/feet). There were ample supplies of surface water storage beginning in 1970 as a result of unusually favorable runoff conditions. (Popkin-Arizona)
W71-02960

SALT CONCENTRATIONS IN SOILS FURROW-IRRIGATED WITH SALINE WATERS,
Texas Agricultural Experiment Station, College Station.
For primary bibliographic entry see Field 02G.
W71-02961

GRAIN SORGHUM ROW SPACING AND PLANTING RATES UNDER LIMITED IRRIGATION IN THE TEXAS HIGH PLAINS,
Agricultural Research Service, Bushland, Tex. Southwestern Great Plain Research Center.
J. T. Musick, and D. A. Dusek.
Texas A and M University, Texas Agricultural Experiment Station, Miscellaneous Publication 932, October 1969. 10 p, 5 tab, 6 fig, 13 ref.

Descriptors: *Sorghum, *Irrigation efficiency, *Spatial distribution, *Planting management, *Rates, Crop production, Crop response, Plant growth, Irrigation practices, Texas, Arid lands, Rainfall, Seasonal, Water utilization, Timing, Plant populations, Lodging, Soil-water-plant relationships, Water conservation.
Identifiers: *Row spacing, Limited irrigation, Texas High Plains.

As groundwater irrigation supplies become more scarce, the limited irrigation approach will become widely used. A 3-year experiment involving row spacing, planting rates, and number and timing of irrigations was conducted at Bushland, Texas, during 1963-1965. Double-row spacing (two 12-inch rows on 40-inch beds) and higher plant populations substantially increased stalk lodging on limited irrigation. The efficiency of one 4-inch seasonal irrigation was substantially increased by double-row spacing. Maximum response ranged from 780 to 820 pounds per acre each year and averaged 800 pounds per acre, or a 16.6 percent increase. Figures show effect of row spacing on seasonal water use efficiency, grain yield and average plant height for various limited irrigation treatments on three stages of plant development. Tables indicate rainfall, field-surveyed practices, planting rate effects, crop yield and row-spacing effects on plant height. (Popkin-Arizona)
W71-02962

WATER USE BY IRRIGATED SUGAR BEETS IN THE TEXAS HIGH PLAINS,
Agricultural Research Service, Bushland, Tex. Southwestern Great Plains Research Center.
For primary bibliographic entry see Field 02G.
W71-02963

CHEMICAL WEED CONTROL FOR THE IRRIGATED AREAS OF ARIZONA, 1970.
Arizona Univ., Tucson. Cooperative Extension Service.

University of Arizona, Cooperative Extension Service and Agricultural Experiment Station, Bulletin A-1, Revised December 1969. 23 p, 3 tab, 7 ref.

Descriptors: *Weed control, *Chemcontrol, *Herbicides, *Application methods, *Arizona, Weeds, Field crops, Vegetable crops, Fruit crops, Arid lands, Farm management, Rates of application, Irrigated lands, Sprays, Calibrations, Irrigation practices, Plant growth regulators, Movement, Mechanical control, Cultivation.
Identifiers: *Herbicide residues, Hand hoeing.

This bulletin summarizes suggestions for weed control practices using herbicides on Arizona irrigated croplands. These data are based on experience, reports from farmers, and research of the agricultural chemicals industry, the U. S. Department of Agriculture, and the University of Arizona. Herbicides can eliminate hand hoeing and may replace much mechanical cultivation. Proper use of herbicides is now a good farming practice. Herbicides must be used only as suggested on the container lable, applied at the correct rate and used with caution. Herbicide residues in the soil, movement along irrigation runs and sprayer calibration techniques are outlined. A list of 37 common, trade and chemical herbicide names is given. A recommended use chart for herbicides includes field crops, vegetables and fruit and general vegetation control. A recommended use chart of herbicides for 10 specific weeds is also presented. (Popkin-Arizona)
W71-02964

GUIDE TO IMPROVEMENT OF ARIZONA RANGELAND.
Arizona Agricultural Experiment Station, Tucson.

University of Arizona, Cooperative Extension Service and Agricultural Experiment Station, Bulletin A-58, July 1969. 94 p, 35 fig, 4 tab, 2 ref.

Descriptors: *Range management, *Brush control, *Fertilization, *Arizona, *Desert plants, Arid lands, Soil texture, Topography, Burning, Seeds, Rates, Planting management, Plants, Shrubs, Range grasses, Grasslands, Maps, New Mexico, Biocontrol, Chemcontrol, Climatic zones, Grazing, Treatment, Timing, Application techniques, Mechanical control, Revegetation.
Identifiers: *Rangeland improvement, *Major Land Resource Areas (MLRA), *Environmental zones (EZ), Seeding.

This bulletin is a guide for ranchers and technicians in techniques of application and planning of range use, brush control, range seeding and range fertilization practices on Arizona rangeland. The guide is a basis for problems analyses and treatment recommendations. Maps identify environmental zones (EZ), major land resource areas (MLRA), topography and soil texture regions. Recommended practices are based on published data and experience. Arizona is divided into MLRA's with 27 EZ's. Each are shown on a map and by a typical photographic view. Proper range use is discussed in terms of management application. Biological, mechanical, chemical and burning methods of

brush control are described for 18 species. Range fertilization and seeding includes grazing management, seedbed preparation, fertilizer practices, and seeding methods for 27 species. Tables include an appendix of common and scientific specie names, brush control, range seeding and cultural-practices recommendations. Thirty-five figures show maps and photographs of MLR's and typical views and vegetation. (Popkin-Arizona)
W71-02965

ESTABLISHMENT AND MANAGEMENT OF IRRIGATED PASTURES IN ARIZONA,
Arizona Univ., Tucson. Cooperative Extension Service.
R. E. Dennis.
University of Arizona, Cooperative Extension Service and Agricultural Experiment Station, Bulletin A-49, Reprinted July 1969. 35 p, 27 fig, 4 tab, 3 ref.

Descriptors: *Pasture management, *Arizona, *Vegetation establishment, *Irrigated land, Range management, Pastures, Land management, Weed control, Timing, Carrying capacity, Grasses, Legumes, Range grasses, Fertilization, Irrigation, Elevation, Soil moisture, Rotations, Soil conservation, Fescues, Bermuda grass, Arid lands, Seeds, Varieties, Grazing, Forages, Rates, Cattle, Nitrogen.
Identifiers: *Permanent pastures, Growing season, Seed inoculation.

Suggestions are given in this bulletin for establishing and managing irrigated pastures such as Arizona's 50,000 acres, where tall fescue grass, bermuda grass and alfalfa predominate. There are descriptions and requirements of 8 grasses and 5 legumes. Elevation, growing season length and soil determine the optimum plant species. Information is presented on legume seed inoculation with nitrogen-fixing bacteria, seed quality, planting dates, seeding rates and methods, irrigation and fertilization. Also included are surface and sprinkler criteria, where frequency is determined by soil and temperature. Irrigated pastures can supplement range forage and are especially useful for grazing cattle. They produce yields on soils too saline for field crops, supplement small farm income and conserve and improve soil. Criteria for land selection and preparation included consideration of rotation grazing, irrigation-and livestock-water availability, land leveling and seedbed moisture conditions. Stand-establishment cost, management of permanent pastures, carrying capacity and grass and legume comparisons are also considered in this bulletin. There are 27 figures of irrigated pastures, plant species and cultural practices. (Popkin-Arizona)
W71-02966

ARIZONA AGRICULTURE 1969.
Arizona Univ., Tucson. Dept. of Agricultural Economics.

University of Arizona, Cooperative Extension Service and Agricultural Experiment Station, Bulletin A-57, March 1969. 26 p, 13 tab, 2 fig, 13 ref.

Descriptors: *Arizona, *Costs, *Agriculture, *Income, *Crop production, Water resources, Groundwater, Surface waters, Prices, Programs, Resource development, Economic efficiency, Evaluation, Irrigated land, Water, Labor, Credit, Field crops, Citrus fruits, Vegetable crops, Melons, Livestock, Arid lands, Cotton, Grains (Crops), Fruit crops, Pumped storage, Reservoir storage.
Identifiers: *Agricultural policy, Central Arizona Project.

This is the 39th annual issue on agricultural costs, income, and production in Arizona. Arizona's agriculture depends largely on water management. Total surface-water diversions and groundwater pumpage during the 1967 water year was 7,986,000 acre/feet, more than any previous recorded year. About 2,835,000 acre/feet were diverted from streams. Groundwater pumpage was about 5,151,000 acre/feet. Increased pumpage was due to newly developed groundwater irrigated areas. Congress passed and the President approved legislation authorizing federal planning and construction of the Central Arizona Project, which may deliver an excess of 2,000,000 acre/feet per year to Central Arizona. The Pacific Southwest Inter-Agency Committee and the U. S. Water Resources Council started a program of comprehensive reconnaissance river basin water planning studies. Included in this bulletin are sections on agricultural prices and policy, commodity programs, comprehensive community resource development, water, labor, agricultural credit, valuation of Arizona's privately owned agricultural lands, field crops, citrus, grapes, vegetables, melons, livestock and livestock products, and principal Arizona crops in 1968. (Popkin-Arizona)
W71-02967

THE INFLUENCE OF XYLEM ARRANGEMENT AND TRANSPIRATION ON THE DISTRIBUTION OF SOLUTES IN COTTON,
Texas A and M Univ., College Station. Dept. of Plant Sciences.
For primary bibliographic entry see Field 02D.
W71-02968

OPTIMUM PLANT POPULATIONS FOR IRRIGATED LATE COTTON PLANTINGS, TEXAS HIGH PLAINS,
Agricultural Research Service, Lubbock, Tex. Crops Research Div.
J. D. Bilbro, Jr.
Texas A and M University, Texas Agricultural Experiment Station, MP-900, November 1968. 7 p, 3 tab, 3 ref.

Descriptors: *Plant populations, *Cotton, *Varieties, *Crop production, *Variability, Soil-water-plant relationships, Time, Texas, Arid lands, Seeds, Plant growth, Rates, Planting management, Optimization, Mature growth stage, Height, Fibers (Plant).
Identifiers: *Lankart Selection 57, *Paymaster 101-A, *Irrigated crops, *Texas High Plains, Bolls.

A 5-year study from 1962-1965 provided data on the effects of planting rates on performance of Lankart Selection 57 and Paymaster 101-A irrigated cotton planted in early June. Highest yields were produced by planting rates of 30 and 18 pounds and by plant populations of 45,000 to 90,000 and 38,000 to 90,000 per acre for Lankart and Paymaster, respectively. Plant populations, yields and varieties for any planting rate were highly variable with time. Paymaster had higher planting populations than Lankart in 4 of the 5 years for any planting rate. Plant populations had little effect on grades, fiber length, strenth, elongation, micronaire fineness or earliness. Increased plant population decreased bolls per plant and plant height and increased lowest boll height. Tables show plant characteristics, cultural practices, and crop yields. (Popkin-Arizona)
W71-02969

PLANNING IN PLANT DISEASE PROGRAMS,
Pennsylvania State Univ., University Park. Whitmore Chemical Lab.
Richard D. Schein.
Agroclimatological Methods; Proceedings of the Reading Symposium, Natural Resources Research, Vol 7, p 141-151, UNESCO, 1968. 3 fig, 16 ref.

Descriptors: *Epidemiology, *Plant diseases, *Plant pathology, *Forecasting, *Pathogenic fungi, Crop response, Rates, Epidemics, Climatology, Rainfall, Temperature, Ecology, Germination, Dispersion, Irrigation effects, Arid lands, Dew, Winds, Microenvironment, Time lag, Time of concentration, Effective precipitation, Environmental effects, Mode of action, Mycology, Insects, Pest control, Planning, Economic efficiency, Phenology, Meteorological data.
Identifiers: *Agroclimatology, *Bioclimatology, *Aerobiology, *Exponential increase.

The prevention cost of plant diseases is today a significant cost of crop production in areas where phenology coincides with weather favorable for pathogens. It is therefore asserted that diseases require consideration in assessing the agricultural potential of an area by reference to meteorological data. In fungal plant diseases, inoculum arrival is followed by moisture-requiring temperature-dependent periods of germination, germ tube growth and colonization. Light effects may also be important. Epidemics may be either tardive or explosive. An explosive epidemic increases at a rate proportional to the initial magnitude (X sub 0), time and average infection rate (r). Anything having a reducing effect on X sub 0 or r will reduce the course of disease. Predisposition may be strongly influenced by temperature or humidity. The source of inoculum may be far away with spread occurring by climatological effects. It may therefore be important, when selecting a crop, to consider potential sources of the disease and prevailing weather patterns between the sites. Since moisture and temperature are critical factors in germination, crop seasons must be selected so that chances of repetitive rainy periods are minimal during critical infection time. In rainless arid areas, overhead irrigation and dew are sources of moisture for the infection process. Similar considerations with incubation and dispersal periods show that timing is the important factor in epidemiology. (Casey-Arizona)
W71-02973

WATER, SOIL, AND CROP MANAGEMENT PRINCIPLES FOR THE CONTROL OF SALTS,
Arizona Univ., Tucson. Dept. of Agricultural Chemistry and Soils.
For primary bibliographic entry see Field 02G.
W71-02977

RAINFALL DISTRIBUTIONS AND SIMULATION MODELS,
University of New England, Armidale (Australia).
For primary bibliographic entry see Field 02B.
W71-03071

SYMPOSIUM: COST BENEFIT ANALYSIS - SPATIAL AND TEMPORAL ALLOCATION OF IRRIGATION WATER: SOME POLICY MODELS AND EXAMPLES,
University of New England, Armidale (Australia); and Guelph Univ. (Ontario).
J. W. B. Guise, and J. C. Flinn.
Australian and New Zealand Association For The Advancement of Science, 41st Congress - Adelaide, Aug 1969. 26 p, 4 tab, 23 ref.

Descriptors: *Model studies, *Simulation analysis, *Cost-benefit analysis, *Irrigation water, Spatial distribution, Temperal distribution, Water policy, Hydroelectric plants, Dams.
Identifiers: South Wales.

Spatio-temporal quadratic programming models, which provide a means of analysing water pricing and allocation decisions in existing water resource developments, were developed and applied using irrigation water demand data derived for the Yanco Irrigation Area in New South Wales. Alternative finite horizon deterministic models, having differing objective functions, were developed for a situation involving a single dam, with competing demands for water from several irrigation areas and a hydro-electric generating plant. A Net Social Payoff type competitive model was used and a set of demand relationships for irrigation water was specified, together with a set of marginal cost relationships relating to the supply of irrigation water. A monopolistic model for irrigation water allocation was derived also. The application of these models presented involved some abstraction from the existing situation in the Murrumbidgee Irrigation Area since water supplies are augmented from the Snowy Mountains Hydro Electric complex. Ex-

tension of the models to cover multiple dam river basins and additional water uses seemed conceptually straight forward but limitations should be recognized. Has 23 references. (Kriss-Cornell)
W71-03072

A STUDY OF WASTEWATER IRRIGATION THROUGH COMPUTER SIMULATION,
Bauer Engineering, Inc., Chicago, Ill.
For primary bibliographic entry see Field 05D.
W71-03126

04. WATER QUANTITY MANAGEMENT AND CONTROL

4A. Control of Water on the Surface

MOVEMENT OF SALTS IN PONDED ANISOTROPIC SOILS,
California Univ., Davis. Dept. of Water Science and Engineering.
For primary bibliographic entry see Field 02G.
W71-02757

USE OF RUNOFF FORECASTING IN RESERVOIR OPERATIONS,
Salt River Project, Phoenix, Ariz.
Thomas T. Wilson, Jr., and Edib Kirdar.
ASCE Proceedings, Journal of the Irrigation and Drainage Division, Vol 96, No IR3, Paper 7541, p 299-308, September 1970. 10 p, 3 fig, 1 tab, 9 ref.

Descriptors: *Reservoir operation, *Runoff forecasting, *Arizona, Electric power, Irrigation water, Municipal water, Industrial water, Water supply, River forecasting, Data collections, Regression analysis, Water management (Applied).
Identifiers: Salt River Reservoir System (Ariz).

The application of runoff forecasting to the operation of the Salt River Project (Arizona) reservoir system has been studied since the late 1930's. The system consists of six dams with a total impoundment capacity of more than 2,000,000 acre-ft. The system provides power production as well as water for irrigation, municipal, and industrial use. During 1967, updated and improved forecast equations were produced from 18 yr of hydrologic records using multiple regression analysis. Forecasts made with these equations were utilized during the runoff seasons of 1967-1968 and 1968-1969. They provided valuable decision data for spill release in 1968 and for allocation of additional water to the users in 1969. (Knapp-USGS)
W71-02758

SPECIAL FLOOD PLAIN INFORMATION STUDY, LUXAPALILA CREEK - TOMBIGBEE RIVER AND TRIBUTARIES, MISSISSIPPI AND ALABAMA.
Corps of Engineers, Mobile, Ala.

Corps of Engineers Flood Plain Report, October 1970. 6 p, 14 plate, 1 tab.

Descriptors: *Flood plains, *Flood routing, *Planning, *Floodways, *Flood control, Potential flow, Flood damage, Mississippi, Alabama, Discharge measurement, Zoning, Watershed management.
Identifiers: Luxapalila Creek (Miss), Flood plain management, 100-year flood.

To provide officials of Columbus and Lowndes County, Mississippi, information about potential flooding along Luxapalila Creek for a flood plain management program, particularly in the lower 20 mi part of the basin, extensive topographic surveys were made and hydrologic data compiled on which this report is based. This creek, drainage area 513,000 acres, rises in Marion County, Alabama and flows southwesterly 75 mi through Fayette and Lamar Counties, Alabama and Lowndes County, Mississippi, to join the Tombigbee River at Columbus. Average fall is 3 1/2 ft per mi. This report presents a history of past flooding and possible future floods, flood plain maps, flood profiles, stage and discharge hydrographs, and other technical data. It is concluded that to realize full benefits offered by the proposed improvement of Luxapalila Creek, floodway regulations incorporating the 100-yr design presented in this report should be adopted by local officials. (Lang-USGS)
W71-02763

FLOOD PLAIN INFORMATION OF LOWER RIVER ROUGE, WAYNE MICHIGAN AND VICINITY.
Corps of Engineers, Detroit, Mich.

Corps of Engineers Flood Plain Report, 1970. 39 p, 3 fig, 9 plate, 12 tab.

Descriptors: *Floods, *Flood damage, *Michigan, Flood plains, Regional flood, Flood forecasting, Flood control.
Identifiers: *Washtenaw and Wayne Counties9mich), Standard project flood, Intermediate regional flood.

A study in Michigan along the Lower River Rouge flood plain from Merriman Road (mile 8.71) through the city of Wayne to Lotz Road (mile 15.52), Canton township, servicing 72 square miles extending over eastern Washtenaw and western Wayne Counties is described to aid in solving local flood problems and in planning the best utilization of flood-prone lands. Maps, profiles, cross sections, and text material relating the extent of past flooding to floods which might occur in the future are based on available records of rainfall, runoff, historical flood heights, and other technical data. Duration of floods is relatively short in the vicinity of Wayne. Stages can rise from stream bed to extreme flood peaks in less than 12 hours following intense rainfall. (Woodard-USGS)
W71-02764

FLOOD PLAIN INFORMATION - LEMON CREEK AT JUNEAU, ALASKA.
Corps of Engineers, Juneau, Alaska.

Corps of Engineers Flood Plain Report, June 1970. 22 p, 4 fig, 11 plate, 3 tab.

Descriptors: *Floods, *Flood damage, *Alaska, Flood plains, Regional flood, Flood forecasting, Flood control.
Identifiers: *Juneau (Alas) area, Standard project flood, Intermediate regional flood.

Flooding along Lemon Creek in the vicinity of Juneau, Alaska is described to aid in solving local flood problems and in planning the best utilization of flood-prone lands. Maps, profiles, cross sections, and text material relating the extent of past flooding to floods which might occur in the future are based on available records of rainfall, runoff, historical flood heights and other technical data. The Intermediate Regional Flood for Lemon Creek would have a water surface elevation of 33 feet at the Glacier Highway Bridge. Standard project flood determinations indicate that flooding, under a combination of most severe conditions, would occur in the Lemon Creek area at an average depth of 2.6 feet higher than the Intermediate Regional Flood. (Woodard-USGS)
W71-02765

ESTIMATING THE FREQUENCY DISTRIBUTION OF HYDROLOGIC RESIDENCE TIMES,
Commonwealth Scientific and Industrial Research Organization, Canberra (Australia). Div. of Land Research.
T. G. Chapman.
In: Symposium on World Water Balance, Vol 1, International Association of Scientific Hydrology Publication No 92, p 136-152, July 1970. 17 p, 12 fig, 2 tab, 4 ref.

Descriptors: *Hydrologic budget, *Water storage, *Frequency analysis, Computer programs, Flow, Open channel flow, Porous media, Streamflow, Groundwater movement, Bank storage, Water balance, Mathematical models, Mixing, Discharge (Water).
Identifiers: Hydrologic residence time.

The frequency distribution of residence times in a hydrologic storage depends on the input regime and the hydraulics of flow through the storage. Estimates of this frequency distribution are useful for planning of efficient data collection and mathematical model developments in studies of water balances at all scales. Estimates of limiting values for the frequency distribution of residence times can be made on the basis of three assumptions about flow through storage: (1) first in first out, no mixing; (2) last in first out, no mixing; and (3) instantaneous complete mixing. It is usually possible to assess which of these assumptions is most realistic or at least to postulate that the real situation is intermediate between two of the assumptions. A computer program was written to determine the frequency distribution of residence times, on the basis of these assumptions, from a given sequence of inputs and outputs and the initial storage volume. Examples of results are given for a surface reservoir, soil moisture in different climatic regimes, a groundwater system, and synthetic input data for a hypothetical storage with constant output. (Knapp-USGS)
W71-02770

FORECASTING OF DRY WEATHER STREAM FLOW,
Baghdad Univ., (Iraq). Coll. of Engineering.
For primary bibliographic entry see Field 02E.
W71-02780

WATER INFLOW COMPUTATION OF THE PLANNED ANKARA CERKESHOYUK RESERVOIR,
Topraksu Central Research Inst., Ankara (Turkey).
Irfan Soykan.
In: Proceedings of Central Treaty Organization Seminar on Evaluation of Water Resources With Scarce Data, March 4-8, 1969, Tehran, Iran, p 413-420, January 1970. 8 p, 1 tab.

Descriptors: *Reservoir design, *Water resources, *Reservoir storage, *Water yield, *Foreign projects, Planning, Model studies, Hydrologic data, Precipitation (Atmospheric), Evapotranspiration, Temperature, Climates, Equations.
Identifiers: *Turkey, *Scarce data, Water inflow, Annual runoff computations.

Principles involved in computing water inflow to farm ponds or reservoirs below ungaged small watersheds are followed in predicting water yield for the planned reservoir project on Karaagizli Creek watershed 40 kilometers southwest of Ankara, Turkey with a drainage area of 21.1 sq km. Results of the different methods applied indicate that the reservoir design should be based on actual flow measurements since the estimated values show great variations. (Woodard-USGS)
W71-02804

KHUZESTAN WATER RESOURCES APPRAISAL,
Khuzestan Water and Power Authority, Tehran (Iran).
Manouchehr Alavi.
In: Proceedings of Central Treaty Organization Seminar on Evaluation of Water Resources With Scarce Data, March 4-8, 1969, Tehran, Iran, p 353-381, January 1970. 29 p, 12 plate, 7 tab, 9 ref.

Descriptors: *Water resources, *Water resources development, *Water management (Applied), Irrigation, Hydroelectric power, Navigation, Rivers, Dams, Flood control, Streamflow, Runoff, Rainfall watersheds (Basins), Hydrologic data, Gaging stations, Discharge measurement, Equations, Design flow, Foreign projects, Dam design.
Identifiers: *Iran.

Accomplishments since 1956 and future plans in developing surface water resources in the Khuzestan region of southwest Iran are reviewed. The area covers almost one-eleventh of Iran's 1,600,000 kilometers area and is the home of nearly one-eighth of the country's 25 million population. Within the region are three large cities. Ahwaz, the oil refining center of Abadan, and the Port of Khorramshahr. Of major important natural resources of Khuzestan are five rivers not touched or divided by international boundaries, the Karun, Dez, Karkheh, Jarrahi and the Hendijan, flowing from the Zagros and Bakhtiari mountains southward through the Khuzestan Plain to the Persian Gulf. The amount of water carried annually by these five rivers has been estimated as 35 billion cubic meters. The first engineering reconnaissance and appraisal of the area suggested building 14 large scale multiple-purpose storage dams to control the five major rivers and to replace their destructive flood damages with irrigation, power and navigation benefits. The schemes will ultimately provide sufficient regulated flow to irrigate almost one million hectares of Khuzestan arable lands and will also be capable of producing more than 6 million killowatts of low-cost hydroelectricity and achieve a high degree of flood control in the lands of the plain. Methods are described for utilizing gaging-station records in expressing formulas and data needed to evaluate and design water-resources projects. Results are given in tables, hydrographs, and maps. (Woodard-USGS)
W71-02808

SPILLWAY DESIGN FLOOD FOR DAMS IN IRAN,
Iran Plan Organization, Tehran.
Parviz Hekmat.
In: Proceedings of Central Treaty Organization Seminar on Evaluation of Water Resources With Scarce Data, March 4-8, 1969, Tehran, Iran, p 341-351, January 1970. 11 p, 1 fig, 1 tab.

Descriptors: *Spillways, *Design flow, *Design storm, Flow control, Dams, Floods, Streamflow, Runoff, Peak discharge, Flow rates, Water management (Applied), Watersheds (Basins), Hydrologic data, Discharge measurement, Gaging stations, Foreign projects.
Identifiers: *Iran, Flood runoff, Spillway design.

Design storms and flood runoffs are used for preparing flood and drainage area relationship curves which are important in the design of dams. The general pattern of rainfall distribution in Iran, except in the Caspian Sea Basin, is a wet season in winter and spring and dry the remainder of the year. The flood season is usually from late winter to mid-spring. River gaging measurement dates back to the year 1945 when a few gaging stations were established on the rivers in the Tehran vicinity. However, today there are about 150 gaging stations on various rivers of Iran. All the records are of relatively short duration, except that of Karun. The accuracy of stream flow records is somewhat questionable, especially for peak discharges of the early years of river gaging. The remoteness of gage locations, poor conditions of access roads, insufficient technical personnel and shortage of equipment are the main causes of relatively poor, but improving data. Considering all of the above points, discharges of 100 rivers of Iran with five or more years of record, were selected. (Woodard-USGS)
W71-02809

RESERVOIR CAPACITY AND OPERATION AS SET BY HYDROLOGICAL AND DRAW-OFF CONDITIONS,
Water Research Association, Marlow (England). Hydrology Div.
J. A. Cole.
In: Proceedings of Central Treaty Organization Seminar on Evaluation of Water Resources With Scarce Data, March 4-8, 1969, Tehran, Iran, p 195-222, January 1970. 27 p, 11 fig, 3 tab, 28 ref.

Descriptors: *Water resources, *Reservoirs, *Model studies, Watershed management, Reservoir storage, Reservoir evaporation, Reservoir leakage, Reservoir silting, Reservoir design, Reservoir construction, Reservoir yield, Overflow, Equations.
Identifiers: *Scarce data, *Spillage, Flow frequencies, Long-term mean, Standard deviation.

Factors that increase and reduce the water supplies in reservoirs are examined under the following headings: (1) How a reservoir acts; (2) Simulation on the action of a reservoir under chosen draw-off rules; (3) Long-term yield from storage; (4) Seasonal storage calculation; and (5) Varying draw-off to meet current conditions of surplus or shortage. Tables, equations, and graphs relate data to reservoir hydrology. Simulation methods are preferable when there are many alternatives possible for operation of reservoirs because under such conditions statistical methods tend to give misleading results. Great care is needed in applying Langbein's curves in the Middle East, especially where the runoff is approximately 5% of the mean annual rainfall. (Woodard-USGS)
W71-02817

SOME CHARACTERISTICS OF THE OPERATIONAL RESERVOIRS IN THE ISRAEL NATIONAL WATER SYSTEM,
For primary bibliographic entry see Field 02H.
W71-02871

THE SAN SIMON WATERSHED; HISTORICAL REVIEW,
Arizona Univ., Tucson. Dept. of Watershed Management.
For primary bibliographic entry see Field 02J.
W71-02874

AN ASSESSMENT OF OPTIMIZATION TECHNIQUES AS APPLIED TO WATER RESOURCE SYSTEMS,
Environmental Dynamics, Inc., Los Angeles, Calif.
For primary bibliographic entry see Field 06A.
W71-02878

EFFECTS OF STREAM STRAIGHTENING ON FLOOD RUNOFF CHARACTERISTICS,
Iowa State Water Resources Research Inst., Ames.
Kenneth L. Campbell, and Howard P. Johnson.
Available from NTIS as PB-196 358, $3.00 in paper copy, $0.95 in microfiche. M.S. Thesis. Iowa State University Water Resources Research Institute Completion Report, October 15, 1970. 132 p, 66 fig, 9 tab, 52 ref. OWRR Project No B-005-IA (4).

Descriptors: *River training, *Water control, *Drainage effects, *Mathematical model, Drainage districts, Iowa, Controlled drainage, Improvement, Levees, Watershed management, Peak discharge, Flood protection, Economic justification.
Identifiers: *Stream modification effects, Flood runoff characteristics, Watershed hydraulics, Boyer River (Iowa).

The effects of much stream straightening and diking on physical flow characteristics were determined on Boyer River in western Iowa. Problems are present in the several drainage districts concerning distribution of cost assessments for construction, repairs, and maintenance along the river. Precipitation and runoff data are tabulated for historic storms. The kinematic flood routing method was used with a computer to obtain discharge hydrographs at several places for two different volumes of river flow. Several flow variations and two flood routing time increments were used for stream conditions before and after the straightening and diking. Values of several physical flow used as indicators of the effects of stream straightening and diking. Flow characteristics used were: (1) peak discharge, (2) time to peak, (3) flood wave travel time, and (4) duration of flooding. Major conclusions are: (1) peak discharge after straightening was increased significantly, (2) flooding was eliminated by the improvements, and (3) flood wave travel time was reduced greatly by straightening the river channel. (Lang-USGS)
W71-02881

WATER RESOURCES AND REGIONAL LAND-USE PLAN,
Harza Engineering Co., Chicago, Ill., Water Resources Planning Div.
For primary bibliographic entry see Field 06B.
W71-02903

FORECASTING WATER DEMANDS AND SYSTEMS CAPABILITIES,
Illinois State Water Survey, Urbana.
For primary bibliographic entry see Field 06D.
W71-02905

HYDROLOGY OF SURFACE WATER IN IRAN,
Ministry of Water and Power, Tehran (Iran). Dept. of Hydrology.
For primary bibliographic entry see Field 07A.
W71-02912

COUNTRY REPORT FOR TURKEY,
Water Operations and Hydrology Lab., Ankara (Turkey).
For primary bibliographic entry see Field 07C.
W71-02914

WATER RESOURCES DEVELOPMENT IN EAST PAKISTAN,
East Pakistan Water and Power Development Authority, Dacca.
Aolad Hosain.
In: Proceedings of Central Treaty Organization Seminar on Evaluation of Water Resources With Scarce Data, March 4-8, 1969, Tehran, Iran, p 37-56, January 1970. 20 p, 3 fig, 1 tab.

Descriptors: *Water resources, *Water resources development, *Surface waters, *Programs, Planning, Flood plains, Flood control, Drainage, Irrigation, Navigation, Hydroelectric power, Watershed management, Cyclones, Groundwater basins, Foreign projects, Hydrologic data.
Identifiers: *East Pakistan, Scarce data.

Since its independence in 1947, East Pakistan has executed 51 hydrological projects concerning flood control, drainage, irrigation, navigation, and hydroelectric power. Results and future objectives of the projects are discussed relative to the development of water resources in the country. Consisting mostly of a delta formed by the Ganges, Brahmaputra and Meghna Rivers and their tributaries, the Province has an area of 55,126 sq mi (one-seventh of all Pakistan). The population was more than 50 million in 1961. A long range Master Plan prepared by the General Consultant of East Pakistan (WAPDA) gives a framework for water resources development as a major part of an improvement program involving all facets of the entire economy. The projects under way are scheduled to match increased growth requirements until 1985. Methods of water development are described, particularly flood protection, drainage and irrigation. Due to the flat terrane and lack of reservoir sites, simple embankments along the streams to confine floods is the most practical solution to periodic flooding of 8 million acres. Water

for irrigation can be obtained from gravity diversions and pumping from streams and by pumping from wells. Cyclones and sea water intrusion are problems that complicate development and management of the water resources. (Lang-USGS)
W71-02915

COUNTRY REPORT FOR PAKISTAN,
Irrigation, Drainage and Flood Control Research Council, Rawalpindi (Pakistan).
For primary bibliographic entry see Field 06B.
W71-02916

COUNTRY REPORT FOR UNITED KINGDOM,
Water Resources Board, Reading (England).
For primary bibliographic entry see Field 06B.
W71-02917

PREPARATION OF LONG TERM FLOW SEQUENCE FROM SHORT TERM RECORD BY STATISTICAL MEANS,
Ministry of Water and Power, Tehran (Iran).
For primary bibliographic entry see Field 02E.
W71-02920

SURFACE WATER SUPPLY OF THE UNITED STATES, 1961-65: PART 9. COLORADO RIVER BASIN - VOLUME 2.
Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 07C.
W71-02924

EVALUATION OF THE STREAMFLOW-DATA PROGRAM IN OREGON,
Geological Survey, Portland, Oreg.
For primary bibliographic entry see Field 07A.
W71-02925

MISCELLANEOUS STREAMFLOW MEASUREMENTS IN IDAHO, 1894-1967,
Geological Survey, Boise, Idaho.
For primary bibliographic entry see Field 07C.
W71-02927

FLOOD PLAIN INFORMATION OF BIG WOOD RIVER, KETCHUM, IDAHO AND VICINITY.
Corps of Engineers, Walla Walla, Wash.

Corps of Engineers Flood Plain Report, June 1970. 30 p, 7 fig, 21 plate, 2 tab.

Descriptors: *Floods, *Flood damage, *Idaho, Flood plains, Regional flood, Flood forecasting, Flood control.
Identifiers: *Ketchum (Ida), Standard project flood, Intermediate regional flood.

The flood situation along Big Wood River above Eagle Creek to below the East Fork, a total of 13.4 miles of the stream is described to aid in solving local flood problems and in planning the best utilization of flood-prone lands. Maps, profiles, cross sections, and text material relating the extent of past flooding to floods which might occur in the future are based on available records of rainfall, runoff, historical flood heights and other technical data. Largest past floods for which records are available were the floods of 1938, 1956, 1958, 1965, 1967, and 1969. Damaging floods are known to have occurred in 1887 and 1894. From records for 55 years to date, some 15 floods have had peak discharges significantly above bankfull in the stream. (Woodard-USGS)
W71-02928

DETERMINATION OF PROBABILITY DISTRIBUTION OF MAXIMUM DISCHARGES ON THE BASINS OF ALL OBSERVED FLOODS,
Technical Univ. of Warsaw (Poland).
For primary bibliographic entry see Field 02E.
W71-02929

IMPROVED PRECISION OF FUTURE HIGH FLOODS,
Central Water and Power Research Station, Poona (India).
For primary bibliographic entry see Field 02E.
W71-02930

PRINCIPLES FOR ELABORATION OF MATHEMATICAL RUNOFF MODELS,
Moscow State Univ., Moscow (USSR).
For primary bibliographic entry see Field 02E.
W71-02931

A NUMERICAL MODEL OF THE RUNOFF PROCESS OF MOUNTAIN RIVERS,
For primary bibliographic entry see Field 02E.
W71-02932

AN ESTIMATE OF DISCHARGE PROBABILITIES,
Research Inst. for Water Resources Development, Budapest (Hungary).
For primary bibliographic entry see Field 02E.
W71-02933

THE ESTIMATION OF EXTREME PRECIPITATION AS THE BASIS FOR DESIGN FLOODS - RESUME OF PRACTICE IN THE UNITED STATES,
Weather Bureau, Silver Spring, Md. Office of Hydrology.
For primary bibliographic entry see Field 02E.
W71-02934

APPLICATION OF THE METHOD OF MAXIMUM RUNOFF COMPUTATION USING THE PRECIPITATION REDUCTION CURVES IN THE MARITSA RIVER BASIN,
Bulgarian Academy of Sciences, Sofia. Inst. of Hydrology and Meteorology.
For primary bibliographic entry see Field 02E.
W71-02937

ON THE EXPEDIENCY OF USING COMBINED SERIES OF HYDROLOGICAL CHARACTERISTICS FOR FLOOD COMPUTATION,
State Hydrological Inst., Leningrad (USSR).
For primary bibliographic entry see Field 02E.
W71-02938

ESTIMATING THE ACCURACY OF STATISTICAL FLOOD VALUES BY MEANS OF LONG-TERM DISCHARGE RECORDS AND HISTORICAL DATA,
For primary bibliographic entry see Field 02E.
W71-02939

ASSESSMENT OF A DESIGN DISCHARGE OF A RIVER,
For primary bibliographic entry see Field 02E.
W71-02940

ESTIMATION OF FLOOD FLOWS USING MATHEMATICAL STATISTICS,
Energoprojekt, Belgrade (Yugoslavia).
For primary bibliographic entry see Field 02E.
W71-02941

SPATIAL AND TEMPORAL ANALYSIS OF MAXIMUM RUN-OFF,
Moscow State Univ., Moscow (USSR).
For primary bibliographic entry see Field 02E.
W71-02942

ON A GENERAL THEORY OF DURATION CURVE AND ITS APPLICATION TO EVALUATE THE PLOTTING POSITION OF MAXIMUM PROBABLE PRECIPITATION OR DISCHARGE,
India Meteorological Dept., New Delhi.
For primary bibliographic entry see Field 02E.
W71-02943

INCREASING THE ACCURACY OF DETERMINATION OF MAXIMUM DISCHARGES AND THEIR EXCEEDENCE PROBABILITY,
For primary bibliographic entry see Field 02E.
W71-02947

EXTRAPOLATION OF DISCHARGE RATING CURVES USING CHEZY'S FORMULA,
State Hydrological Inst., Leningrad (USSR).
For primary bibliographic entry see Field 02E.
W71-02948

IMPACT-TYPE ENERGY DISSIPATOR FOR STORM-DRAINAGE OUTFALLS STILLING WELL DESIGN.
Army Engineer Waterways Experiment Station, Vicksburg, Miss.

Technical Report No 2-620, March 1963. 66 p, 9 tab, 37 plates.
Identifiers: *Storms, Drainage, *Underground structures, Design, *Erosion, Control, Pipes, Plastics, Energy, Impact, Fluid flow, Piezoelectric gages, *Stilling wells, *Energy dissipators.

An impact-type energy dissipator consisting of a vertical section of circular pipe affixed to the outlet end of a storm drainage outfall, termed a stilling well, was studied in the laboratory to determine the energy loss coefficient and the effects of the geometrical components of such a structure. The results were generalized and given in terms of dimensionless parameters. Investigations were conducted with a 0.99-ft-diameter model stilling well which had a 2-ft-diameter collar attached to the top to simulate a broad-crested circular weir, and incoming pipes with diameters of 0.33, 0.40, and 0.60 ft on slopes of 1 on 1, 1 on 2.2, and 1 on 4. There is an optimum depth of the stilling well below the invert of the incoming pipe, dependent on the slope of the incoming pipe. Limited tests indicated that there is also an optimum height of the well above the pipe invert for each given set of conditions. In regard to energy dissipation, test results show that the smaller the ratio of the diameter of the incoming pipe to that of the stilling well and the flatter the slope of the incoming pipe, the greater the value of the energy loss coefficient. The energy loss coefficient is less for full pipe flow than for partial pipe flow. Discharge coefficients for a circular stilling well were determined for both partial and full pipe inflows and free outflow conditions, and empirical equations were developed.
W71-02954

GUIDE TO IMPROVEMENT OF ARIZONA RANGELAND.
Arizona Agricultural Experiment Station, Tucson.
For primary bibliographic entry see Field 03F.
W71-02965

COST-BENEFIT ANALYSIS FOR INLAND NAVIGATION IMPROVEMENTS,
Northwestern Univ., Chicago, Ill. Econometrics Center.
For primary bibliographic entry see Field 06B.
W71-02981

BOARD OF HUDSON RIVER REGULATING DIST V FONDA, J AND G RR (TAKING OF PROPERTY TO REGULATE RIVER FLOW FOR PUBLIC BENEFIT).
For primary bibliographic entry see Field 06E.
W71-03026

BAY RIDGE DOCK CO V UNITED DRY DOCKS, INC (GRANTEE OF BOTTOMLAND MAY FILL IN TO BULKHEAD LINE).
For primary bibliographic entry see Field 06E.
W71-03030

UNITED STATES V WEST VIRGINIA (POWER OF THE UNITED STATES TO PREVENT CONSTRUCTION OF DAMS ON NAVIGABLE RIVERS).
For primary bibliographic entry see Field 06E.
W71-03041

TIME SEQUENCING OF ELEMENT CONSTRUCTION IN A MULTI-RESERVOIR SYSTEM,
Water Resources Engineers, Inc., Springfield, Va.
For primary bibliographic entry see Field 06A.
W71-03069

RUNOFF AND EROSION CONTROL BY SEEDED AND NATIVE VEGETATION ON A FOREST BURN: BLACK HILLS, SOUTH DAKOTA,
Forest Service, Fort Collins, Colo. Rocky Mountain Forest and Range Experiment Station.
Howard K. Orr.
USDA Forest Service Research Paper RM-60, September 1970. 12 p, 7 fig, 3 tab, 5 ref.

Descriptors: *Erosion control, *Overland flow, *Forest fires, *Vegetation regrowth, *Land management, *South Dakota, Cover crops, Precipitation (Atmospheric), Forest management, Runoff, Erosion, Streamflow, Flow rates, Sediment transport, Vegetation establishment, Vegetation effects, Reforestation, Plants, Soil stabilization.
Identifiers: *Black Hills (S Dak).

Growth of seeded species in combination with reestablishment of native vegetation reduced overland runoff and soil erosion to tolerable levels within one to four growing seasons. Gross rainfall was a poor indicator of runoff and soil erosion from small plots. Trends were best defined by declining rates of runoff and sediment production per unit of excess rainfall. Sixty percent ground-cover density (live vegetation plus litter) is postulated as the minimum necessary for soil stabilization. This cover density almost certainly could not have been reached within the 4-year study period without seeding. Seeded grasses--timothy and Kentucky bluegrass on coarse-textured soil and timothy and smooth brome on fine-textured soil--were especially important because of their dispersion and abundance, and persistence of litter production. (Woodard-USGS)
W71-03131

FLOOD PLAIN INFORMATION, MENDENHALL RIVER, JUNEAU, ALASKA.
Corps of Engineers. Alaska District.

Corps of Engineers Flood Plain Report, June 1970. 23 p, 7 fig, 12 plate, 3 tab.

Descriptors: *Floods, *Flood damage, *Flood plains, *Alaska, Historic flood, Flood forecasting, Regional flood, Design flood, Glaciers, Land use, Snowmelt.
Identifiers: *Mendenhall River, Juneau (Alaska), Intermediate regional floods, Standard project flood.

A record is given of the largest known floods along Mendenhall River, a glacier-fed stream which drains a 103 sq mi area ranging in elevation from sea level to 7,000 ft. The floodplain area is 8 mi northwest of Juneau. Forecasts are made of probable future floods of Intermediate Regional size (average of once in 100 yr) and Standard Project Floods (largest expected to occur) for planning the best utilization of flood-prone lands. The greatest known flood occurred in Sept. 1927, but caused small damage because of little utilization of the floodplain. Now because of large industrial development underway and planned and need for land for the expanding economy of the Juneau area land use must be controlled to avoid flood damage. Accurate records of stage and flow rates were started in 1965 with installation of USGS gaging stations on the stream. Scarce data indicate that large floods caused by intense rainfall can occur any time during summer or early fall, but a period of high water also occurs every spring caused by snow melt. Channel flow velocities during major floods range up to 17 ft per sec; the velocities on the floodplain vary, usually at rates less than 3 ft per sec. Major floods would be out of banks for about 4 days. (Lang-USGS)
W71-03134

DAMS AND SPILLWAYS (PROCEDURES FOR INITIATING CONSTRUCTION OR ALTERATION).
For primary bibliographic entry see Field 06E.
W71-03227

NATHANSON V WAGNER (ALTERED FLOW OF SURFACE RUNOFF ALLEGED TO HAVE DAMAGED DOWNHILL LANDOWNER).
For primary bibliographic entry see Field 06E.
W71-03231

DYKSTRA V DARLING (DRAINAGE RIGHTS OF ADJACENT PROPERTY OWNERS).
For primary bibliographic entry see Field 06E.
W71-03232

CITIZEN'S HARDWARE AND FURNITURE CO V CHICAGO, ROCK ISLAND AND PACIFIC RY (PROXIMATE CAUSE OF FLOODING MUST BE PROVEN BY PLAINTIFF).
For primary bibliographic entry see Field 06E.
W71-03235

DUCK ISLAND HUNTING AND FISHING CLUB V EDWARD GILLEN DOCK, DREDGE AND CONST CO (FEDERAL AND STATE APPROVAL OF RIVER PROJECTS AS PREREQUISITE TO A VALID CONTRACT).
For primary bibliographic entry see Field 06E.
W71-03239

CHICAGO, ST L AND N O RR V BULLOCK (LIABILITY FOR FLOOD DAMAGE CAUSED BY OVERFLOW OF DRAINAGE DITCH OBSTRUCTED BY RAILROAD EMBANKMENT).
For primary bibliographic entry see Field 06E.
W71-03240

BECK V STATE EX REL ATTNY GEN (RIPARIAN RIGHT TO DRAIN LAKE TO MAINTAIN NATURAL WATER LEVEL).
For primary bibliographic entry see Field 06E.
W71-03242

REED V CULLOR (LIABILITY FOR CROP DAMAGE CAUSED BY OBSTRUCTION OF NATURAL STREAM FLOW).
For primary bibliographic entry see Field 06E.
W71-03243

HENICLE V PENNSYLVANIA RR (REPULSION OF SURFACE WATER BY RAILROAD).
For primary bibliographic entry see Field 06E.
W71-03244

DRAINAGE DISTRICTS (ANNEXATION, REPAIR, CONSTRUCTION, IMPROVEMENT: COUNTY COURT JURISDICTION).
For primary bibliographic entry see Field 06E.
W71-03264

TUCKER V HAGAN (LIABILITY FOR DISCHARGE OF SURFACE RUNOFF UNTO SERVIENT ESTATE).
For primary bibliographic entry see Field 06E.
W71-03265

MCWHORTER V CITY OF CLARKSBURG (PRESCRIPTIVE RIGHT TO OVERFLOW LAND AS A DEFENSE).
For primary bibliographic entry see Field 06E.
W71-03268

KITCHEN LUMBER CO V TALLASSEE POWER CO (WASHOUT OF RAILROAD BRIDGE CAUSED BY NEGLIGENT OPENING OF DAM FLOODGATES).

206 NC 515, 174 SE 427-431 (1934).

Descriptors: *North Carolina, *Dams, *Bridges, *Flooding, Lumbering, Access routes, Railroads, Concrete dams, Backwater, Floodgates, Overflow, Rivers, Washouts, Damages, Compensation, Profit, Adjudication procedure, Judicial decisions, Legal aspects, Rainfall, Rain, Rainfall-runoff relationships, Remedies.

Plaintiff lumber company sued defendant damowner for damages caused by the opening of defendant's dam. Plaintiff owned a railroad bridge downriver from the dam, and following a heavy rainfall defendant opened the dam gates, allowing a tremendous amount of water to rush downriver and wash out plaintiff's bridge. Plaintiff sought damages from the bridge destruction and recovery of lost profits because of an inability to market its lumber. The trial court had refused to admit defendant's evidence that plaintiff had not mitigated damages. On this appeal, defendant asserted that there was insufficient evidence to support the jury finding that the bridge was negligently destroyed and that the trial court erred by refusing to admit the evidence on mitigation. The appellate court stated that where an owner interferes with the natural course of a stream, he is strictly liable for proximate injury unless it was caused by an uncontrollable intervening force. Reviewing the evidence, the court held that it was sufficient to support the jury's finding. However, finding error in refusal to admit evidence on mitigation, the court directed a new trial on the issue of lost profits. (Hart-Florida)
W71-03269

NECHES CANAL CO V MILLER AND VIDOR LUMBER CO (LOSS OF PROFITS FROM UNLAWFUL DAM ERECTION).
For primary bibliographic entry see Field 06E.
W71-03270

BARR V SPALDING (UNITED STATES' LIABILITY FOR RAISING RIVER ABOVE HIGH WATER MARK).
For primary bibliographic entry see Field 06E.
W71-03272

FLAMBEAU RIVER LUMBER CO V LAKE SUPERIOR DIST POWER CO (OBSTRUCTION OF NAVIGABLE STREAM BY IMPROPER DAM OPERATION).
For primary bibliographic entry see Field 06E.
W71-03275

MORTON V CHESAPEAKE AND O RY (ALTERATION OF STREAM'S COURSE AS PERMANENT OR TEMPORARY INJURY).
For primary bibliographic entry see Field 06E.
W71-03277

SINCLAIR REFINING CO V SMITH (LIABILITY FOR DECREASE IN CHANNEL DEPTH CAUSED BY NEGLIGENT DREDGING).
For primary bibliographic entry see Field 06E.
W71-03283

NORFOLK AND W RY V MCCOY (RAILROAD'S FILL DIVERTS RIVER, ERODING FARMLAND).
For primary bibliographic entry see Field 06E.
W71-03286

LAMB KNITTING MACH CO V CHICOPEE MFG CO (LITIGATION OVER AGREEMENT TO FURNISH WATER POWER).
For primary bibliographic entry see Field 06E.
W71-03287

IN RE VILLAGE OF LYNBROOK (VALUE OF LAND CONDEMNED FOR DRAINAGE EASEMENT WHERE OTHER EASEMENTS ALREADY EXIST).
For primary bibliographic entry see Field 06E.
W71-03292

STATE DISPOSITION OF SUBMERGED LANDS VERSUS PUBLIC RIGHTS IN NAVIGABLE WATERS,
For primary bibliographic entry see Field 06E.
W71-03296

4B. Groundwater Management

INVESTIGATION OF GROUND-WATER RESOURCES IN THE DASHT-MOGHAN AREA, AZARBIJAN, IRAN,
Tehran Regional Water Authority (Iran).
For primary bibliographic entry see Field 02F.
W71-02806

SUBSIDENCE AND GROUNDWATER OFF-TAKE IN THE BATON ROUGE AREA,
Louisiana Water Resources Research Inst., Baton Rouge.
For primary bibliographic entry see Field 02F.
W71-02828

PROGRESS REPORT ON GROUNDWATER INVESTIGATION IN IRAN,
Ministry of Water and Power, Tehran (Iran). Div. of Groundwater.
For primary bibliographic entry see Field 02F.
W71-02913

WATER-LEVEL DATA FROM OBSERVATION WELLS IN THE SOUTHERN HIGH PLAINS OF TEXAS, 1965-70,
Texas Water Development Board, Austin.
For primary bibliographic entry see Field 07C.
W71-02921

THE TWICE-USED WATER,
For primary bibliographic entry see Field 02F.
W71-02959

ARIZONA AGRICULTURE 1970.
Arizona Univ., Tucson. Dept. of Agricultural Economics.
For primary bibliographic entry see Field 03F.
W71-02960

WATER USE BY IRRIGATED SUGAR BEETS IN THE TEXAS HIGH PLAINS,
Agricultural Research Service, Bushland, Tex. Southwestern Great Plains Research Center.
For primary bibliographic entry see Field 02G.
W71-02963

ARIZONA AGRICULTURE 1969.
Arizona Univ., Tucson. Dept. of Agricultural Economics.
For primary bibliographic entry see Field 03F.
W71-02967

DEVELOPMENT AND FIELD TESTING OF LARGE VOLUME REMEDIAL TREATMENTS FOR GROSS WATER CHANNELING,
Pan American Petroleum Corp., Tulsa, Okla.
L. R. Smith, C. R. Fast, and O. R. Wagner.
Journal of Petroleum Technology, Vol 21, No 8, p 1015-1025, August 1969. 5 tab, 11 fig, 12 ref.

Descriptors: *Oil wells, *Water wells, Drilling fluids, Mud, Water flood, *Injection wells.
Identifiers: *Water channeling, *High flow capacity zones, Acidic silica gels, Alkaline silica gels, Sweep efficiency, Laboratory tests, Field tests, Low-cost bentonite-nutshell slurries.

This paper describes laboratory development and field testing of plugging agents for large volume treatments of waterflood channeling problems which arise from fluids passing through interwell fractures or high permeability strata. To improve sweep efficiency in reservoirs where water bypassing occurs through interwell fractures, large volume of slurries may be injected at pressures above the fracture opening level to pack the fracture with settled solids and shut off flow. Low-cost benfonite-nutshell slurries were developed and proved effective in field testing for improving sweep efficiency. To improve sweep efficiency in reservoirs where water channeling occurs through high permeability zones or where water is lost from desired injection intervals through localized fractures, long-set-time alkaline silica gels may be injected to plug the by-pass zones. Effective treatments using only a few thousand barrels of these gels are possible. Field testing demonstrated that the alkaline silica gels are effective in reducing flow through by-pass zones. (Campbell-NWWA)
W71-02982

SAMPLE CATCHER YIELDS CLEAN CUTTINGS, RETAINS FINES,
Petrocraft Products Ltd., Calgary (Alberta).
R. B. Morris.
World Oil, Vol 166, No 6, p 97-98, May 1968. 3 fig, 1 ref.

Descriptors: *Sampling, Data collections, *Drilling, Homogeneity, *On-site data collections, Reliability, Logging (Recording), Petrography, Drill holes.
Identifiers: *Retention of fines, Well-site lithologic logging.

Simple machine has been developed that provides selected, screened and washed subsurface rock cuttings. It consists of an outer cylinder, top plate and inner cylinder; apparatus is attached to mud tank in front of shale shaker or collector. It is activated by shaker and contains agitated water supply. Since human error is minimized from collecting process, superior well samples can be obtained. The machine's operation, advantages and limitations are discussed. Primary design features are: (1) catch, sieve, wash and collect aggregate or representative well cuttings in predetermined quantities, (2) provide a thorough but gentle washing action, (3) retain fines even when drilling carbonate, and (4) exclude most cavings. (Campbell-NWWA)
W71-02987

WELL LOGGING IN GROUNDWATER HYDROLOGY,
Geological Survey, Denver, Colo.
W. Scott Keys.
Groundwater, Vol 6, No 1, p 10-18, January-February 1968. 8 fig, 12 ref.

Descriptors: *Drilling, *Groundwater, Hydrology, Borehole geophysics, Water wells, Oil industry, *Logging (Recording).
Identifiers: *Electrical logging, *Radioactive logging, Flowmeter, Caliper, Fluid resistivity, Gradient and differential temperature, Sonic velocity.

In 1966 more than 50 billion gallons of water was pumped daily from an estimated 10 to 15 million water wells in the United States, one-sixth of the national withdrawal of water. On the basis of past rates of increase, a much greater future use of groundwater is suggested. Annual investment in water wells is one-half to three-quarter billion dollars, not including pumps and plumbing. In 1964 approximately 436,000 new wells were drilled, less than 1 percent of these wells were logged by any geophysical means. The application of geophysical well logging to groundwater hydrology is comparable to its use in petroleum exploration in the 1930's; however, equipment and interpretation techniques developed in the oil industry are available now for use in groundwater investigations. Although most petroleum well logging techniques may be utilized in hydrology, modifications in equipment and interpretation are necessary because of basic economic and environmental differences between petroleum and groundwater evaluation. If logging is to be widely applied to groundwater exploration and evaluation the expense of equipment and services must be reduced. This can be accomplished, because most water wells are not as deep as oil wells and the temperatures and pressures are lower. The U.S. Geological Survey is conducting research on the application of borehole geophysics to groundwater hydrology. (Campbell-NWWA)
W71-02988

NEW TEMPERATURE LOG PINPOINTS WATER LOSS IN INJECTION WELLS,
Mitchell and Associates, Houston, Tex.
E. A. Riley.
World Oil, Vol 164, No 1, p 69-72, January 1967. 3 fig, 1 ref.

Descriptors: *Oil wells, *Water injection, Waste disposal, Water wells, Casing, Logging, Water flood, *Injection wells.
Identifiers: *Temperature log, *Fractional temperature anomalies, Downhole fluid movement, Casing leaks, Lost circulation zone.

A new, extremely accurate differential temperature survey technique has been used successfully to precisely locate a downhole water loss in a waterflood injection well, which was previously undetectable by any other means. The differential temperature log accurately measures fractional temperature anomalies associated with fluid movements downhole. Besides being used to detect fluid communication downhole in water injection wells, the technique is applicable for finding tubing-casing leaks, gas communication, productive zones, lost circulation zones, production profiles and gas-oil-water contacts. The use is discussed of the differential temperature survey as a diagnostic, injection profile tool. (Campbell-NWWA)
W71-02990

FACTORS AFFECTING CURRINGS REMOVAL DURING ROTARY DRILLING,
Shell Development Co., Houston, Tex.
E. A. Hopkin.
Journal Petroleum Technology, Vol 19, No 6, p 807-814, June 1967. 6 tab, 8 fig, 10 ref.

Descriptors: *Rotary drilling, Sampling, Data collections, Oil wells, *Wells, *Drilling fluids, Mud.
Identifiers: Laboratory tests, Field tests, *Particle slip velocity, Laminar annular mud flow, Stuck drill pipe, Mud viscosity, Canada.

Laboratory tests and field experience in Canada indicated the magnitude of some of the factors affecting ability of drilling mud to clean the hole. A correlation was observed between funnel viscosity and particle slip velocity. A relationship was observed between the Bingham yield value of the mud and the particle slip velocity. Laboratory tests indicated little change in slip velocity with funnel viscosities up to about 80 sec/qt or to yield values of about 15 lb/100 sq ft. The slip velocity of the particles studies varied from 160 ft/min with water to nearly zero for high mud viscosities. Increasing the mud density, creating laminar annular mud flow, or rotating the drill pipe may improve the carrying capacity of mud. Field tests indicated that, during fast upper-hole drilling, the rate of cutting removal must be sufficient to maintain the concentration of cuttings in the annulus at less than 5 percent by volume to prevent balled-up drill collars and stuck drill pipe. (Campbell-NWWA)
W71-02991

QUICKSAND AND WATER WELLS,
P. F. Patchick.
Groundwater, Vol 4, No 2, p 32-46, April 1966. 1 tab, 11 fig, 32 ref.

Descriptors: *Water wells, *Quicksand, *Drilling, Groundwater, Water supply, Wells, Well screens, Stoke's law.
Identifiers: Cable-tool completion, Rotary completion, Quicksand aquifer, Development techniques, Uncemented alluvium, Fluvioglacial sediments, Lacustrine sediments.

Quicksand is no myth, nor is it a rare phenomenon, either on the surface or in the subsurface. In water wells, a 'quick' or 'heaving' condition may commonly exist if a confined, permeable, loose silt, sand or gravel stratum is continuous to distant higher ground, and is subject to greater head of water existing at higher elevations. Stoke's Law explains why fine, rounded grains become 'quick'. Quicksand drilling and completion problems with cable-tool and rotary wells and suggestions for overcoming them are discussed. (Campbell-NWWA)
W71-02993

THE DRILL-STEM TEST: THE PETROLEUM INDUSTRY'S DEEP-WELL PUMPING TEST,
Geological Survey, Washington, D.C. Water Resources Div.
J. D. Bredehoeft.
Groundwater, Vol 3, No 3, p 31-36, July 1965. 1 tab, 6 fig, 8 ref.

Descriptors: *Oil industry, *Oil wells, *Water wells, *Pressure head, *Permeability, *Water chemistry, Hydraulics, Hydrologic data, Testing.
Identifiers: *Drill-stem test, *Petroleum engineering, Formation fluid, Formation pressure, Formation coefficient of permeability.

Drill-stem tests provide the petroleum industry information on three critical properties of subsurface formations--pressure head, permeability, and water chemistry--that the groundwater hydrologist also seeks in making pumping tests of water wells. As it is increasingly necessary to study the hydraulic and geochemical properties of deep-lying rocks in order to understand the behavior of groundwater, data on drill-stem tests made by the petroleum industry become an important source of information which othewise is unobtainable because of the high cost. Data from these tests made by methods currently in use are highly useful in water studies. Both petroleum engineering and groundwater hydrology stand to profit substantially from an increase in the interchange of ideas and techniques. (Campbell-NWWA)
W71-02994

HYDROLOGY OF LIMESTONE TERRANES - ANNOTATED BIBLIOGRAPHY OF CARBONATE ROCKS,
Alabama Geological Survey, University.
For primary bibliographic entry see Field 02F.
W71-03109

ANNOTATED BIBLIOGRAPHY ON ARTIFICIAL RECHARGE OF GROUNDWATER, 1955-67,
Geological Survey, Washington, D.C.
D. C. Signor, D. J. Growitz, and William Kam.
For sale by the Superintendent of Documents, US Government Printing Office, Wash, DC, 20402 - Price $0.65. Geological Survey Water - Supply Paper 1990, 1970. 141 p.

Descriptors: *Bibliographies, *Artificial recharge, *Abstracts, Water spreading, Injection wells, Water reuse, Infiltration, Groundwater movement, Pit recharge, Reclaimed water.
Identifiers: *Artificial recharge bibliography.

This bibliography emphasizes the technology of groundwater recharge; however, annotations of articles on waste water reclamation, groundwater management and groundwater basin management are included. Subjects closely related to artificial recharge, including colloidal flow through porous media, field or laboratory instrumentation, and waste disposal by deep well injection are included where they specifically relate to potential recharge problems. Artificial groundwater recharge is a means of conserving surface runoff for future use in places where it would otherwise be lost, of protecting groundwater basins from salt-water encroachment along coastal areas, and of storing and distributing imported water. The bibliography is arranged alphabetically by author. The indexing is by subject and geographic location. Each article was assigned the key words or phrases to best characterize its contents. (Knapp-USGS)
W71-03130

WATER RESOURCES AND RELATED GEOLOGY OF DERA ISMAIL KHAN DISTRICT, WEST PAKISTAN, WITH REFERENCE TO THE AVAILABILITY OF GROUNDWATER FOR DEVELOPMENT,
Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 02F.
W71-03132

WASTE WATER RECLAMATION USING GROUNDWATER RECHARGE - A REVIEW,
New South Wales Univ., Kensington (Australia). School of Civil Engineering.
B. W. Gould.
In: Proceedings of Groundwater Symposium, New South Wales University, Manly Vale, Australia, August 28-29, 1969: New South Wales University Water Research Laboratory Report No 113, Paper No 6, p 76-104, April 1970. 29 p, 42 ref.

Descriptors: *Water reuse, *Artificial recharge, *Reclaimed water, *Reviews, Hydrogeology, Waste water treatment, Water chemistry, Eutrophication, Urbanization, Water demand, Water yield, Water utilization, Water management (Applied), Water quality.
Identifiers: *Waste water reclamation.

The use of artificial recharge to reclaim waste water is reviewed. In some places where local fresh water supplies are limited, and water can be brought to the area only at considerable cost, waste water is being reclaimed for reuse. The use of waste water to recharge aquifers is a reclamation method which has a number of technical and aesthetic advantages, and has been the subject of laboratory, field, and full-scale investigations in America, Israel, and Holland. When waste water percolates through soil, natural physical, chemical, and microbiological processes not only can cause large reductions in the amount of putrescible organic material and in the number of bacteria, but also can remove suspended material and reduce the amount of nutrients which could cause eutrophic conditions. For injection wells, water should be treated to a fairly high degree of organic purity; but seepage basins operated on a suitable intermittent schedule under good conditions can produce potable groundwater even from sewage which has had only primary treatment. (Knapp-USGS)
W71-03136

SYSTEM MODELLING FOR CONJUNCTIVE USE OF A GROUNDWATER AQUIFER AND A SURFACE RESERVOIR,
New South Wales Univ., Kensington (Australia). School of Civil Engineering.
D. T. Howell, and P. R. Johnston.
In: Proceedings of Groundwater Symposium, New South Wales University, Manly Vale, Australia, August 28-29, 1969: New South Wales University Water Research Laboratory Report No 113, Paper No 10, p 152-160, April 1970. 9 p, 2 fig, 5 ref.

Descriptors: *Systems analysis, *Dynamic programming, *Water resources development, *Conjunctive use, Alluvium, Streamflow, Water storage, Reservoirs, Aquifers, Reservoir operation, Water management (Applied).
Identifiers: *Australia, *Hunter River (Australia).

Decisions must be made in designing for the conjunctive use of a reservoir and aquifer. Some of the methods available for analyzing system models and making these decisions are described. Details of a particular study using data from the Upper Hunter River, Australia serve to illustrate these methods. The practical difficulties involved can be largely overcome by field testing of the aquifer in the investigation stage of a project, or by a more refined application of the procedure several years after the start of implementing a project, when more data become available. (Knapp-USGS)
W71-03139

CITY OF PHILADELPHIA V PHILADELPHIA SUBURBAN WATER CO (COMPETING USES OF LIMITED RESOURCES).
For primary bibliographic entry see Field 06E.
W71-03233

4C. Effects on Water of Man's Non-Water Activities

LAND TREATMENT IN AGRICULTURAL WATERSHED HYDROLOGY RESEARCH,
Agricultural Research Service, Beltsville, Md. Hydrograph Lab.
L. M. Glymph, and H. N. Holtan.
In: Proceedings of Central Treaty Organization Seminar on Evaluation of Water Resources With Scarce Data, March 4-8, 1969, Tehran, Iran, p 271-298, January 1970. 28 p, 17 fig, 5 tab, 25 ref.

Descriptors: *Rainfall-runoff relationships, *Agricultural watersheds, *Demonstration watersheds, Mathematical models, Model studies, Management, Evapotranspiration, Watershed management, Water utilization.
Identifiers: Watershed models.

Studies of the hydrology of farm watersheds are reviewed with emphasis on relationships between treatment and runoff coefficients. The rate of runoff depends on the size and shape of the watershed, surface slopes, nature and amount of vegetation, soil permeability, initial soil saturation, arrangements and character of drainage channels, evaporation, storage and underground conditions, and the duration and intensity of rainfall. Experimental watershed research seeks to establish principles and describe them in numerical terms so that by knowing the geology, soils, topography, and characteristics of the stream channel system of an ungaged watershed, its performance may be predicted under various land use patterns and treatments when subject to an assumed single precipitation event or to a series of such events. A mathematical model for computing the components of watershed hydrology in their natural chronological and spatial sequences of occurrence is under study by the USDA Hydrograph Laboratory. (See also W70-04723) (Knapp-USGS)
W71-02812

WATER RESOURCES AND REGIONAL LAND-USE PLAN,
Harza Engineering Co., Chicago, Ill., Water Resources Planning Div.
For primary bibliographic entry see Field 06B.
W71-02903

CENTRAL OREGON COAST. VOLUME VI. RECREATION TOURISM.
Oregon Univ., Eugene. Bureau of Governmental Research and Service.
For primary bibliographic entry see Field 06B.
W71-03204

PENNSYLVANIA ENVIRONMENTAL COUNCIL, INC V BARTLETT (HIGHWAY RELOCATION ENDANGERS STREAM ECOLOGY).
For primary bibliographic entry see Field 06E.
W71-03258

4D. Watershed Protection

GEOCHEMICAL BALANCE OF A SMALL WATERSHED AND ITS GEOMORPHIC IMPLICATIONS,
Maryland Geological Survey, Baltimore; Vanderbilt Univ., Nashville, Tenn. Dept. of Geology; and Johns Hopkins Univ., Baltimore, Md. Dept. of Earth and Planetary Sciences.
For primary bibliographic entry see Field 02K.
W71-02761

SEDIMENTATION ENGINEERING, CHAPTER IV. SEDIMENT SOURCES AND SEDIMENT YIELDS.
American Society of Civil Engineers, New York.
For primary bibliographic entry see Field 02J.
W71-02855

THE SAN SIMON WATERSHED; HISTORICAL REVIEW,
Arizona Univ., Tucson. Dept. of Watershed Management.
For primary bibliographic entry see Field 02J.
W71-02874

FLOOD AND EROSION CONTROL (PROJECT AUTHORITY AND ADMINISTRATION).
For primary bibliographic entry see Field 06E.
W71-03261

05. WATER QUALITY MANAGEMENT AND PROTECTION

5A. Identification of Pollutants

WATER RESOURCES DATA FOR TEXAS, 1968 - PART 2. WATER QUALITY RECORDS.
Geological Survey, Austin, Tex. Water Resources Div.
For primary bibliographic entry see Field 02K.
W71-02759

RELATIVE TOXICITIES OF SELECTED CHEMICALS TO SEVERAL SPECIES OF TROPICAL FISH,
Hawaii Univ., Honolulu. Water Resources Research Center.
For primary bibliographic entry see Field 05C.
W71-02829

MERCURY IN THE ENVIRONMENT.
Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 05B.
W71-02886

MERCURY CONTENT OF ROCKS, SOILS, AND STREAM SEDIMENTS,
Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 05B.
W71-02888

ANALYTICAL METHODS FOR DETERMINATION OF MERCURY IN ROCKS AND SOILS,
Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 05B.
W71-02896

TRITIUM FALLOUT IN THE PACIFIC UNITED STATES,
California Univ., Los Angeles. Dept. of Chemistry.
For primary bibliographic entry see Field 02K.
W71-02898

TRITIUM PROFILE AT THE NORTH PACIFIC (1969) GEOSECS INTERCALIBRATION STATION,
For primary bibliographic entry see Field 02K.
W71-02900

TRACE ELEMENT CALIBRATIONS AND PROFILES AT THE GEOSECS TEST STATION IN THE NORTHEAST PACIFIC OCEAN,
Woods Hole Oceanographic Inst., Mass.
For primary bibliographic entry see Field 02K.
W71-02901

METHODS OF ANALYZING OILFIELD WATERS: CESIUM AND RUBIDIUM,
Bureau of Mines, Bartlesville, Okla. Bartlesville Petroleum Research Center.
For primary bibliographic entry see Field 02K.
W71-02949

EXTRACTION AND ANALYSIS OF ORGANOCHLORINE INSECTICIDES FROM LAKE SEDIMENTS,
Wisconsin Univ., Madison. Dept. of Soil Science.
Michael G. Browman.
Wisconsin Water Resources Center, Madison, Ph D Thesis, 1970. 113 p, 5 fig, 19 tab, 104 ref. OWRR Project B-016-WIS (10); and USDA, ARS, Contract No 12-14-100-8154 (41).

Descriptors: *Separation techniques, *Lake sediments, *Insecticides, *Pesticides, Aldrin, Heptachlor, Dieldrin, DDT, *Gas chromatography, Analysis, Lakes, Wisconsin, Pollutant identification.
Identifiers: BHC, DDE, DDD, Methoxychlor, Aluminum oxides, Trout, Little Arbor Vitae, Tomahawk, Mendota.

The azeotropic hexane: acetone (41:59) mixture was adapted for extraction of organochlorine insecticides from lake sediments. Sediment samples are shaken twice with the extractant and the pooled extracts are washed with water. The insecticides in the hexane layer are concentrated to an appropriate volume and determine radiometrically or by gas liquid chromatography. Sediments from hard and soft water lakes were utilized in combination with the following insecticides: aldrin, gamma-BHC, heptachlor, heptachlor expoxide, p, p'-DDE, dieldrin, o, p'-DDT, p, p'-DDD, p, p'-DDT, and p, p'-methoxychlor. Best cleanup of extracts was achieved with basic and neutral aluminum oxides. The highest recovery of insecticides was obtained from samples spiked and extracted in the wet state. (See also W71-02979) (Chesters-Wisconsin)
W71-02978

THE PERSISTENCE AND ANALYSIS OF ORGANOCHLORINE INSECTICIDES IN SOILS AND SEDIMENTS,
Wisconsin Univ., Madison. Dept. of Soil Science.
William Trautmann.
Wisconsin Water Resources Center, Madison, Ph D Thesis, 1970. 138 p, 15 fig, 16 tab, 120 ref.

Descriptors: *Irradiation, *Degradation, *Soil properties, *Insecticides, Aldrin, Heptachlor, Dieldrin, Analysis, Pollutant identification.
Identifiers: Gamma-BHC, p, p'-DDD, p, p'-DDT, Beta-BHC, Subirrigated soils, Ella prairie loamy sand, Poygan lacustrine clay.

This study was concerned with the effect of soil moisture and irradiation on volatilization and degradation of selected organochlorine insecticides in soils and sediments of different composition. Sterile and non-sterile samples of sub-irrigated sandy prairie soil and lacustrine clay were spiked with a mixture of 6 insecticides and incubated under forced aeration for 30 days. Volatilization of gamma-BHC, aldrin, and heptachlor exposide was greater from sandy than from clay soil but failed to reveal the effect of treatment. Volatilization of dieldrin, p, p'-DDD and p, p'-DDT from both soils did not exceed 3%. A fraction of the gamma-BHC was transformed into the degradation by-product, the beta-BHC. The uneven heat distribution within the oven of sweep codistillation units was corrected by an addition of a solid aluminum block with 4 Storherr tubes, 4 carrier gas preheat tubes, 2 heating elements, and a thermocouple. This modification eliminated chromatographic inaccuracies resulting from coextracted components of high R sub t values and permitted reproducible recovery of insecticides. (See also W71-02978) (Chesters-Wisconsin)
W71-02979

GENERAL LIMNOLOGICAL AND BIOLOGICAL STREAM SURVEYS AS A SIMPLE MEANS OF DETECTING POLLUTION AND CONTROLLING THEIR EFFECTS,
Landesstelle fuer Gewasserkunde, Karlsruhe (West Germany).
W. Schmitz.
Fifth International Water Pollution Research Conference, San Francisco, July 26-August 1, 1970. Preprint, 6 p, 3 fig, 1 tab, 3 ref.

Descriptors: *Water pollution control, *Classification, Water pollution effects, *Limnology, Organic wastes, Biochemical oxygen demand, Water quality control, Organic loading, Nitrites, *Monitoring, Dissolved oxygen, Pollutant identification, Control systems, *Bioindicators.
Identifiers: *Stream surveys, Germany, Oxygen supply, *Organic pollution load, *Water pollution criteria.

The degree of stream pollution is classified for streams of the Baden-Wurttemberg area of Germany by two methods: (1) Definitions of classes of organic pollution load and, (2) definition of classes of oxygen supply. To estimate the degree of organic pollution load some rather general criteria of the limnological character of the stream and simple observations of the flora and fauna are used. BOD, NH4.., and NO2-ranges were given for each of the five pollution classes based on organic pollution load. Five pollution classes were given on the basis of oxygen supply (greater than 8 mg. O2/1., 6-8, 4-6, 2-4, and less than 2 mg. O2/1.) (Katz-Washington)
W71-03096

NITRATE AND AMMONIUM CONTENTS OF WISCONSIN LIMESTONES,
Wisconsin Univ., Madison. Dept. of Soil Science.
For primary bibliographic entry see Field 02K.
W71-03111

DETERMINATION OF MERCURY IN WATER,
Geological Survey, Denver, Colo.
Marvin J. Fishman.
Analytical Chemistry, Vol 42, No 12, p 1462-1463, October 1970. 2 p, 2 tab, 3 ref.

Descriptors: *Chemical analysis, *Trace elements, *Heavy metals, *Poisons, Water pollution, Pollutant identification, Spectrophotometry, Pollutant identification.
Identifiers: *Mercury.

A technique is described for the determination of mercury in fresh waters. Mercury is collected from an acidified water sample by amalgamation on a silver wire. The silver wire is then electrically heated in an absorption cell placed in the light beam of an atomic absorption spectrophotometer. The mercury vapors are drawn through the cell with a water aspirator and the absorption is plotted on a recorder. Samples containing at least 0.1 microgram of mercury per liter can be analyzed

directly; samples containing more than 1.5 microgram per liter must first be diluted. None of the substances commonly occurring in natural water interferes, although iron and sulfide, if present, cause low recovery of mercury. (Knapp-USGS)
W71-03114

CARBON DIOXIDE IN THE SURFACE WATER OF THE ICE-COVERED BERING SEA,
Alaska Univ., College. Inst. of Marine Science.
For primary bibliographic entry see Field 02K.
W71-03115

THE DETERMINATION OF SHORT-CHAIN FATTY ACIDS IN AQUEOUS SOLUTION BY GAS-LIQUID CHROMATOGRAPHY,
National Inst. for Water Research, Pretoria (South Africa).
J. J. Van Huyssteen.
Water Research, Vol 4, No 10, p 645-659, October 1970. 5 p, 8 fig, 1 tab, 83 ref.

Descriptors: *Pollutant identification, *Organic acids, *Anaerobic digestion, *Chromatography, Sewage treatment, Gas chromatography, Waste treatment, Analytical techniques, Chemical analysis.
Identifiers: *Short-chain fatty acids, *Gas-liquid chromatography.

A method is presented for the direct determination of short-chain fatty acids in aqueous solution by gas-liquid chromatography. A flame ionization detector is used with glass columns packed with a polystyrene-divinylbenzene resin. Complete separation of both the normal and iso-acids (from C2 to C6) was achieved. The linearity of the detector over the concentration range 0 to 2500 mg per liter for C2 and C3 and 0-1000 mg per liter for the C4 to C6 acids was also established. Per unit weight, acetic acid gave responses of the order of those of the higher homologues. Column characteristics (as evidenced by retention times and detector responses) remained unimpaired after well over 500 injections of fatty acid solutions, water and digester samples. (Knapp-USGS)
W71-03118

AUTOMATED ANALYSIS OF AMMONIA IN WATER,
National Inst. for Water Research, Pretoria (South Africa).
J. E. Harwood, and D. J. Huyser.
Water Research, Vol 4, No 10, p 695-704, October 1970. 10 p, 6 fig, 1 tab, 38 ref.

Descriptors: *Pollutant identification, *Ammonia, *Color reactions, *Colorimetry, Chemical analysis, Water analysis, Nitrogen compounds, Ammonium compounds, Nitrogen, Analytical techniques.
Identifiers: Ammonia analysis.

An automated method to determine ammonia-nitrogen over a wide concentration does not require changes in manifold. Sensitivity is altered by changes in the reagents. The most sensitive determination is based on the use of nitro-prusside as catalyst over the range 0-1 mg NH3-N per liter using a 15 mm flowcell and no range scale expansion. The phenol-hypochlorite reaction is almost specific for ammonia-nitrogen. The effect of metal ions was also investigated. An adequate buffering system should be used to eliminate the effect of sample pH. (Knapp-USGS)
W71-03119

POLLUTION SURVEILLANCE AND DATA ACQUISITION USING MULTISPECTRAL REMOTE SENSING,
Michigan Univ., Ann Arbor. Dept. of Environmental Health.
Chester T. Wezernak, and Fabian C. Polcyn.
Water Resources Bulletin, Vol 6, No 6, p 920-934, November-December 1970. 15 p, 12 fig, 6 ref.

Descriptors: *Remote sensing, *Water pollution sources, *Pollutant identification, *Photometry, *Spectrophotometry, Instrumentation, Aircraft, Infrared radiation, Electromagnetic waves, Measurement, Surveys.
Identifiers: Multispectral remote sensing.

Large scale water resources investigations and effective pollution surveillance programs require the development of additional instrumentation and techniques to supplement existing methods of data acquisition. As a result, interest is growing in the concept of remote sensing. A passive multichannel scanner system is capable of sensing reflected and emitted energy simultaneously in a number of narrow spectral intervals in the ultraviolet, visible and infrared region of the solar spectrum. The system basically consists of a spectrometer for dispersing the radiation spectrally and filtered detector arrays placed at the focal points of a double ended optical-mechanical scanner. In the field of water pollution control remote spectral measurements can be used to detect and identify effluent discharge. Temperature is closely related to water pollution. The ability to detect small temperature differences can be used to locate effluent outfalls including submerged outfalls. An important feature of the instrumental system used in this investigation is the ability to examine a scene in 17 bands distributed between 0.3 and 13.5 microns. This means that in addition to the detection capability referred to above, the system serves as a 17 channel spectrometer with electronic processing features. Each effluent is more clearly defined by examination at its optimum wavelength; and, hence, dispersion patterns of the effluent are best determined within a particular spectral band width. (Knapp-USGS)
W71-03127

TOXICITY OF PCP FOR THE 'DOJO' FISH, MISGURUNUS ANGUILLICAUDATUS (CANTOR), WITH SPECIAL REFERENCE TO THE SIZE OF FISHES (IN JAPANESE),
Ihara Agricultural Chemicals Inst., Shimizu (Japan).
Shoji Asano, Sumio Nagasawa, and Kazunobu Kondo.
English summary. Japanese Journal of Applied Entomology and Zoology, Vol 8, No 3, p 185-190, 1964. 6 tab, 4 fig, 3 ref.

Descriptors: *Bioassay, *Toxicity, Water pollution effects, Lethal limit, *Phenols, *Regression analysis, Mathematical studies, Laboratory tests.
Identifiers: *PCP, Dojo fish, Misgurunus anguillicaudatus, *Fish size effects, Body weight.

An improved method for eliminating the effect of variance in body weight on the result of the bioassay experiment of PCP for the 'Dojo' fish is presented. A linear relation was obtained between the log body weight of 'Dojo' fish and the log lethal time in various concentrations of PCP. The time at the average body weight of all fishes tested in the regression line mentioned above was considered as the median lethal time. The median lethal concentration derived from the relation between the median lethal time and log concentration coincided well with the result obtained by the usual median lethal concentration is evaluated at 24 hours after dipping. The median lethal concentration determination from large numbers mentioned above also coincided completely with that determined from small numbers. (Sjolseth-Washington)
W71-03188

5B. Sources of Pollution

EVALUATION OF EARTHLY MATERIALS FOR USE IN DECONTAMINATION OF WATER,
Auburn Univ., Ala. Water Resources Research Inst.
Joe B. Dixon.
Available from NTIS as PB-196 308, $3.00 in paper copy, $0.95 in microfiche. Auburn University Water Resources Research Institute Bulletin 703, 1970. 74 p. OWRR Project A-001-ALA (1).

Descriptors: *Chemical degradation, *Clay minerals, *Pesticides, *Pesticide kinetics, Adsorption, Alabama, Path of pollutants, Pesticide residues, Soil water movement, Translocation, Endrin, Diquat, Dieldrin, Aldrin, Soil chemical properties, Soil chemistry.
Identifiers: *Pesticide degradation, Amiben.

Endrin decomposition was greater on clays saturated with Al than those saturated with Ca, indicating that endrin decomposition will be increased by acidity of clay or soil. Increasing relative humidity generally reduced adsorption and decomposition of endrin. Endrin decomposition may be increased in sediments or soils by drying them by frequent tillage in a dry season. Diquat cations were 68 to 100% replace by K ions in soil clays. Some diquat may remain active in the presence of kaolinite and vermiculite. Sorption of the amiben anion was greatest for minerals with hydroxyl surfaces and least for 2:1 layer structured minerals. Greater leaching could occur in soils dominated by 2:1 type minerals. Sorption of the methyl ester of amiben was largely controlled by organic matter content regardless of clay minerals present. Many of the soils of the southeastern United States are acid and contain vermiculite and kaolinite as the major clay minerals. These soils may be effective in decomposing endrin, diquat, and other organic molecules. (See also W71-02753 thru W71-02756) (Knapp-USGS)
W71-02752

ENDRIN, DIELDRIN AND ALDRIN ADSORPTION AND DECOMPOSITION BY CLAY MINERALS AND SOIL CLAYS,
Auburn Univ., Ala. Dept. of Agronomy and Soils.
N. P. Agnihotri, and J. B. Dixon.
In: Auburn University Water Resources Research Institute Bulletin 703, p 4-20, 1970. 17 p, 3 fig, 1 tab, 29 ref. OWRR Project A-001-ALA (1).

Descriptors: *Chemical degradation, *Clay minerals, *Pesticides, *Pesticide kinetics, Adsorption, Alabama, Path of pollutants, Pesticide residues, Soil water movement, Translocation, Endrin, Diquat, Dieldrin, Aldrin, Soil chemical properties, Soil chemistry.
Identifiers: *Pesticide degradation, Amiben.

Adsorption and decomposition of endrin were determined on Ca- and Al-saturated reference clay mineral and soil clay samples at 48 and 100% relative humidity and in vacuum at different temperatures. More endrin was adsorbed and decomposed by Al-saturated clay samples than Ca-saturated clay samples at different humidities and in vacuum. Adsorption and decomposition of endrin were greatest in vacuum and declined with increasing relative humidity. Al-saturated vermiculite and montmorillonite adsorbed and decomposed more endrin than other clay minerals tested. Hematite and goethite adsorbed and decomposed the smallest amounts of endrin. Adsorption and decomposition of endrin by gibbsite were less than by silicate clay minerals and were much greater than by iron minerals. (See also W71-02752) (Knapp-USGS)
W71-02753

EXCHANGE OF DIQUAT CATIONS IN SOIL CLAYS, VERMICULITE AND MONTMORILLONITE WITH HOAI INTERLAYERS,
Auburn Univ., Ala. Dept. of Agronomy and Soils.
J. B. Dixon, D. E. Moore, N. P. Agnihotri, and D. E. Lewis, Jr.
In: Auburn University Water Resources Research Institute Bulletin 703, p 21-35, 1970. 15 p, 3 fig, 3 tab, 7 ref. OWRR Project A-0001-ALA (1).

Descriptors: *Chemical degradation, *Clay minerals, *Pesticides, *Pesticide kinetics, Adsorption, Alabama, Path of pollutants, Pesticide residues, Soil water movement, Translocation, Endrin, Diquat, Dieldrin, Aldrin, Soil chemical properties, Soil chemistry.

Identifiers: *Pesticide degradation, Amiben.

Clay samples were saturated with diquat cations by a centrifuge washing procedure. Diquat adsorbed was determined by difference. Exchangeable diquat was replaced by washing samples with KCl solutions. Exchange of diquat cations to KCl solutions was from 23 to 26% complete for three Wyoming montmorillonites and was from 35 to 44% for three model montmorillonites from southeastern United States. Diquat cations were 59% exchangeable in a nontronite. Diquat cations satisfied 53 and 82% of the cation exchange charge of two vermiculites. Eleven soil clays had from 27 to 98% of their cation exchange charge countered by diquat cations. The exchange of diquat from soil clays was from 68 to 100%. Montmorillonitic soil clays fixed more diquat than soil clays dominated by vermiculite, intergrade-chlorite and kaolinite. High layer charge density in montmorillonite and vermiculite contributes to diquat exchangeability in those minerals. The content of vermiculite in soil clays is directly related to diquat exchangeability. (See also W71-02752) (Knapp-USGS)
W71-02754

SORPTION OF AMIBEN AND THE METHYL ESTER OF AMIBEN BY CLAY MINERALS AND SOILS,
Auburn Univ., Ala. Dept. of Agronomy and Soils.
L. D. Spivey, and J. B. Dixon.
In: Auburn University Water Resources Research Institute Bulletin 703, p 36-51, 1970. 16 p, 1 fig, 5 tab, 13 ref. OWRR Project A-001-ALA (1).

Descriptors: *Chemical degradation, *Clay minerals, *Pesticides, *Pesticide kinetics, Adsorption, Alabama, Path of pollutants, Pesticide residues, Soil water movement, Translocation, Endrin, Diquat, Dieldrin, Aldrin, Soil chemical properties, Soil chemistry.
Identifiers: *Pesticide degradation, Amiben.

Kaolinite, halloysite, gibbsite, and goethite, at pH values of 4.4 to 5.3, sorbed 38 to 88% of the applied amiben. Little or no amiben was sorbed by illite and vermiculite. Treatment to remove iron oxides reduced sorption by soil clays. Sorption was greatest on acid soils high in kaolinitic clay. Amiben sorption by soils was reduced by application of sulfate and phosphate salts. The methyl ester of amiben was sorbed 3 to 30% by all reference clay minerals. Sorption of the amiben ester by soil was related primarily to organic matter percentage. (See also W71-02752) (Knapp-USGS)
W71-02755

GLYCEROL VAPOR ADSORPTION ON CLAY MINERALS AND MONTMORILLONITIC SOIL CLAYS,
Auburn Univ., Ala. Dept. of Agronomy and Soils.
D. E. Moore, and J. B. Dixon.
In: Auburn University Water Resources Research Institute Bulletin 703, p 52-73, 1970. 22 p, 3 fig, 2 tab, 18 ref. OWRR Project A-001-ALA (1).

Descriptors: *Adsorption, *Clay minerals, *Alcohols, *Pesticides, Laboratory tests, Expansive clays, Soils, Soil chemical properties, Pesticide kinetics, Pesticide residues, Sorption, Surfaces.
Identifiers: *Glycerol sorption (Clays).

Adsorption isotherms of glycerol were obtained for clay fractions of montmorillonite, vermiculite, kaolinite and eight soil clays at 80C in an evacuated system. Montmorillonite samples gave BET monolayer values from 211 to 230 mg glycerol per g of montmorillonite. Monolayer values calculated for soil montmorillonites from BET monolayer values and corrected for impurities were 209 to 239 mg glycerol per g of montmorillonite in soil clays. Vermiculite gave BET monolayer values of 40 mg and 96 mg per g of clay for 2 to 0.2 micron and 0.2 to 0.08 micron sizes. (See also W71-02752) (Knapp-USGS)
W71-02756

HYDROGEOLOGY OF SOLID WASTE DISPOSAL SITES IN MADISON, WISCONSIN,
Wisconsin Univ., Madison. Water Resources Center.
Robert F. Kaufmann.
Available from NTIS as PB-196 360, $6.00 in paper copy, $0.95 in microfiche. Wisconsin Water Resources Center, Technical Report, University of Wisconsin, Madison, 1970. 361 p, 25 fig, 62 tab, 100 ref. OWRR Project A-018-WIS (1).

Descriptors: *Hydrogeology, *Landfills, Groundwater, Phosphorus, Nitrogen, Aquatic life, Discharge (Water), Dissolved oxygen, Wisconsin, Solid wastes, *Waste disposal, Groundwater recharge.
Identifiers: Flow systems, Stream standards, Urbanization, Leachate, Madison (Wis), Pumpage, Lake Monona (Wis), *Groundwater pollution, *Solid waste disposal, *Sanitary landfills.

Two existing, and 24 prospective, sanitary landfill sites in Madison, Wisconsin were examined. Former groundwater discharge characteristics of the existing sites have been altered as a result of the placement of fill and groundwater pumpage. Surface- and groundwater resources adjacent to landfill areas were found to receive pollutants although adverse effects were limited. Less than 5 per cent of the total organic and inorganic nitrogen and total soluble phosphorus entering Lake Monona was attributable to the landfill operation. Groundwater recharge was between 35 to 50 per cent of annual precipitation with lateral discharge to adjacent ground- and surface-water resources. The increase in dissolved chemical species was high, but restricted to local areas. Over the past 27 years, background quality in the two creeks receiving drainage changed by 10-22 fold decrease in organic nitrogen and 2-2.9 fold decrease in inorganic nitrogen. Phosphorus levels increased 2-6 fold. Decreased base flow and urbanization have possibly influenced these changes.
W71-02825

DDT IN A FRESHWATER MARSH: A SIMULATION STUDY,
Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.
For primary bibliographic entry see Field 05C.
W71-02836

EFFECT OF THE SAVANNAH RIVER PLANT ON ENVIRONMENTAL RADIOACTIVITY.
Du Pont de Nemours (E. I.) and Co., Aiken, S.C. Savannah River Lab.

Available from NTIS as DPST-70-30-1, $3.00 in paper copy, $0.95 in microfiche. Semiannual Report, July-December 1969. April 1970, 19 p. AEC AT (07-2)-1.
Identifiers: *Water pollution, Radiological contamination, *Nuclear power plants, *Radiological contamination, *Air pollution, Radiological contamination, Milk, Food, South Carolina.

The results are presented of the environmental monitoring program for the atmosphere, vegetation and food, milk, and water. The quantity of radioactive waste released by the Savannah River Plant to its environs was, for the most part, too small to be distinguished from natural background radiation or was obscured by fallout from offsite sources. Beta activity in air, which showed no relationship with plant operations, was about the same as that observed for the previous six-month period and was twofold higher than the same period of 1968. Radioactive materials in fish flesh continued to be far below levels considered significant from a health standpoint. The average concentration of any radionuclide in river water at Highway 301 did not exceed 0.4% of the concentration guide.
W71-02837

EVALUATION OF ACARICIDES FOR CONTROL OF THE STRAWBERRY SPIDER MITE ON COTTON AND ALFALFA,
Arizona Univ., Tucson. Agricultural Extension Service.
For primary bibliographic entry see Field 03F.
W71-02875

CHEMICAL, PHYSICAL AND BIOLOGICAL DYNAMICS OF NORTHERN PRAIRIE LAKES,
South Dakota State Univ., Brookings.
For primary bibliographic entry see Field 05C.
W71-02880

MERCURY IN THE ENVIRONMENT.
Geological Survey, Washington, D.C.

For sale by Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402. Price: $0.70. Geological Survey Professional Paper 713, 1970. 67 p.

Descriptors: *Pollutant identification, *Trace elements, *Heavy metals, *Poisons, *Water pollution sources, Industrial wastes, Solutes, Chemical wastes, Analytical techniques, Neutron activation analysis, Chromatography, Colorimetry, Flame photometry, Surveys, Geochemistry, Reviews.
Identifiers: *Mercury.

The compounds of mercury, like many other chemical compounds, are dispersed throughout rocks, soil, air, water, and living organisms by a complex system of physical, chemical, and biological controls. Combinations of these controls have developed interesting patterns of mercury and its compounds in the world. Rain washes mercury from the atmosphere. Such scrubbing accounts for the fact that the mercury content of rainwater averages about 0.2 ppb. Tests in Sweden have shown that mercury carried down by rain adds to each acre of land per year about the same amount of mercury added by mercury-bearing seed dressing. Mercury from either source is held tightly by the upper 2 inches or so of soil. Surface waters except where they are influenced by manmade pollution, generally contain less than 0.1 ppb of mercury. Mercury from industrial processes in this country are estimated at 600 tons per year and superimpose a significant amount of manmade pollution upon the pattern established by nature. Mercury contents of many industrial outfalls and sludge banks range from a trace to 100,000 ppb. Several instances of human poisoning have been reported from consumption of fish exposed to local concentrations of mercury. The Geological Survey's analytical methods have progressed from improved wet chemical dithizone colorimetric method, through a series of spectrographic, atomic absorption, and activation analyses procedures, until it now is capable of measuring with confidence mercury concentrations as low as 1 part per trillion in the atmosphere and 0.1 ppb in water or earth materials. (See also W71-02887 thru W71-02896) (Knapp-USGS)
W71-02886

SUMMARY OF THE LITERATURE ON THE INORGANIC GEOCHEMISTRY OF MERCURY,
Geological Survey, Washington, D.C.
Michael Fleischer.
In: Mercury in the Environment, Geological Survey Professional Paper 713, p 6-13, 1970. 8 p, 79 ref.

Descriptors: *Bibliographies, *Geochemistry, *Heavy metals, *Trace elements, *Poisons, Water pollution sources, Air pollution, Path of pollutants, Surveys, Reviews, Geochemistry, Water chemistry.
Identifiers: *Mercury.

The mercury content of most igneous rocks is generally less than 200 ppb and probably averages less than 100 ppb. Rocks from a few areas in the world, notably Crimea and the Donets Basin, U.S.S.R., show extremely high contents of mercury, which makes general averages of abundance of

doubtful significance. Most sedimentary rocks have mercury contents less than 200 ppb Hg. Most natural water (groundwater, river water, sea water) contain less than 2 ppb Hg. High concentrations of mercury have been found in waters from hot springs and in brines from a petroleum field in California. Mercury is presumably dissolved by groundwaters passing over rocks and is added to waters in considerable amounts by industrial wastes, notably by alkali-chlorine plants using the mercury cell method and by the paper pulp industry. The mercury is apparently removed in large part by adsorption on clays and on hydrous oxides of iron and manganese, and also by algae and plankton. Mercury is present in the atmosphere, with background values of less than 1 to a few nanograms per cubic meter. Over metallic ore deposits, the content of mercury is appreciably higher. Volcanic emanations have high contents of mercury, and must contribute a large amount of mercury to the atmosphere. In addition to such 'natural pollution', mercury is added to the atmosphere by the burning of coal and petroleum and from stack gases of smelters treating copper, lead, and zinc ores. (See also W71-02886) (Knapp-USGS)
W71-02887

MERCURY CONTENT OF ROCKS, SOILS, AND STREAM SEDIMENTS,
Geological Survey, Washington, D.C.
A. P. Pierce, J. M. Botbol, and R. E. Learned.
In: Mercury in the Environment, Geological Survey Professional Paper 713, p 14-16, 1970. 3 p, 1 fig, 1 tab, 12 ref.

Descriptors: *Bibliographies, *Geochemistry, *Heavy metals, *Trace elements, *Poisons, Water pollution sources, Air pollution, Path of pollutants, Surveys, Reviews, Geochemistry, Water chemistry.
Identifiers: *Mercury.

Mercury is routinely determined in U. S. Geological Survey laboratories with atomic absorption equipment. Statistics are tabulated on mercury content of rocks, soils, and sediments as determined by the atomic absorption method, from 3 readily available sources: analytical data that are computer stored and that are immediately available for processing, data that have already been published, and data that are in the process of publication. A wide range from 10 to 6,000 ppb mercury, is seen in modal mercury values. This variability indicates that levels of natural mercury concentrations, or abundance, are relatively complex functions of geologic conditions and that criteria for either mercury mineralization or abnormal mercury contamination should be evaluated separately in any single area of interest. Less than 20 percent of the rock samples and stream-sediment samples have concentrations greater than 1,000 ppb mercury. For rocks and stream sediments the upper limit of the ranges of 90th percentiles indicate that any mercury values greater than 1,000 ppb are considered worthy of further investigation as possible results of (1) mercury mineralization processes or (2) surface contamination by mercury-bearing wastes. Statistics for only 4 sets of soil samples are available, and these suggest a background value of 500 ppb mercury for soils in Western United States. (See also W71-02886) (Knapp-USGS)
W71-02888

CHEMICAL BEHAVIOR OF MERCURY IN AQUEOUS MEDIA,
Geological Survey, Washington, D.C.
John D. Hem.
In: Mercury in the Environment, Geological Survey Professional Paper 713, p 19-24, 1970. 6 p, 2 fig, 11 ref.

Descriptors: *Water chemistry, *Heavy metals, *Geochemistry, *Trace elements, *Poisons, Water pollution sources, Path of pollutants, Reviews, Aqueous solutions, Biochemistry, Chemical reactions.
Identifiers: *Mercury.

The chemical behavior of the element mercury in water is highly interesting, although rather complicated and still not entirely explainable. A general statement of what is known and can reasonably be inferred about the aqueous chemistry of mercury is given. This review should aid in the interpretation of analyses for mercury in surface and groundwater and may help predict what will happen when mercury is added to river or lake water in waste-disposal processes. Mercury forms many solute species. Some of these are complex ions with a high degree of stability. A calculation of solubility for mercury must take into account a large number of possible forms. This situation is further complicated because of the possible existence of different oxidation states. Mercury in the form of liquid metal is somewhat volatile and can escape from systems open to the atmosphere, and many mercury compounds are somewhat volatile also. Mercury forms many strong organic complexes and is generally much more soluble in organic liquids than in water. Methyl mercuric ion is cited in publications by various authors as the most important form in fish and various other food products of animal origin. (See also W71-02886) (Knapp-USGS)
W71-02889

MERCURY CONTENTS OF NATURAL THERMAL AND MINERAL FLUIDS,
Geological Survey, Washington, D.C.
D. E. White, M. E. Hinkle, and Ivan Barnes.
In: Mercury in the Environment, Geological Survey Professional Paper 713, ' 25-28, 1970. 4 p, 16 ref.

Descriptors: *Water chemistry, *Heavy metals, *Geochemistry, *Trace elements, *Poisons, Water pollution sources, Path of pollutants, Reviews, Aqueous solutions, Biochemistry, Chemical reactions.
Identifiers: *Mercury.

Dilute thermal springs contain readily detectable mercury. The springs include high-temperature waters of Yellowstone National Park, which are closely associated with extensive Pleistocene volcanism. Some California thermal waters, and nonthermal waters of appreciable salinity but not closely associated with volcanism, contain mercury in the range of 1 to 3 ppb, concentrations notably higher than Yellowstone National Park waters. Sediments associated with some of these springs are rich in mercury, containing about 50 to 5,000 times the mercury content of ordinary rocks, and the mercury contained is presumed to have been transported by the spring water. Petroleum and especially the tarry residues of petroleum contain a range from 300 to 500,000 ppb. In the formation of some mercury deposits, petroleum and hydrocarbon gases apparently played a role, but the origin and nature of the fluids that have formed most large mercury deposits are not yet clearly understood. Data are incomplete for hot spring and volcanic gases, especially in view of anomalous contents of mercury in associated solid phases which indicates vapor transport. (See also W71-02886) (Knapp-USGS)
W71-02890

SOURCES AND BEHAVIOR OF MERCURY IN SURFACE WATERS,
Geological Survey, Washington, D.C.
R. L. Wershaw.
In: Mercury in the Environment, Geological Survey Professional Paper 713, p 29-31, 1970. 3 p, 22 ref.

Descriptors: *Water chemistry, *Heavy metals, *Geochemistry, *Trace elements, *Poisons, Water pollution sources, Path of pollutants, Reviews, Aqueous solutions, Biochemistry, Chemical reactions.
Identifiers: *Mercury.

Before one declares a water body polluted with waste mercury from man's activities, it is necessary to know the natural background level of the metal. Water samples were collected for this purpose by district offices of the U. S. Geological Survey, in cooperation with the Federal Water Quality Administration, during May, June, and July 1970. The 73 samples, representing surface waters in 31 states, range in concentration from less than 0.1 to 17 ppb. Of the total, 34 contained less than the detectable concentration (0.1 ppb). Of the remainder, 27 samples ranged from 0.1 to 1.0 ppb and 10 samples ranged from 1.0 to 5.0 ppb. Only two samples contained more than 5.0 ppb, the Public Health Service limit for potable water supplies. Natural surface waters contain tolerably small concentrations of mercury except in areas draining mercury deposits. Industrial, agricultural, scientific, and medical uses of mercury and mercury compounds introduce additional mercury into surface waters. Whatever its source, the concentration of mercury compounds, dissolved or suspended, is reduced rapidly by sorption and by complexing reactions with clays, plankton, colloidal proteins, humic materials, and other organic and inorganic colloids. These reactions tend to keep the concentration of dissolved mercury at levels near the normal background except at points of actual mercury discharge. (See also W71-02886) (Knapp-USGS)
W71-02891

BIOLOGICAL FACTORS IN THE CHEMISTRY OF MERCURY,
Geological Survey, Washington, D.C.
Phillip E. Greeson.
In: Mercury in the Environment, Geological Survey Professional Paper 713, p 32-34, 1970. 3 p, 1 fig, 14 ref.

Descriptors: *Biochemistry, *Poisons, *Heavy metals, *Water pollution sources, *Water pollution effects, Toxicity, Public health, Chemical properties, Biological communities, Food chains.
Identifiers: *Mercury.

Although mercury is not considered to be an essential food material for organisms, it is incorporated into the body of the organism by virtue of its presence in the water. Mercury in living tissues is believed to be largely organic and primarily methyl mercury. Much of the inorganic and organic mercurial wastes from industrial effluents are converted by anaerobes into methyl mercury or dimethyl mercury. Methyl mercury tends to concentrate in living tissue and at critical concentration can be extremely toxic. Aquatic organisms, as well as man, will concentrate mercury within their bodies when the intake rate exceeds the elimination rates. The result, under these conditions, is a buildup with time to the extent that the accumulated mercury can become toxic and, eventually, lethal. (See also W71-02886) (Knapp-USGS)
W71-02892

MERCURY CONTENT OF PLANTS,
Geological Survey, Washington, D.C.
Hansford T. Shacklette.
In: Mercury in the Environment, Geological Survey Professional Paper 713, p 35-36, 1970. 2 p, 1 tab, 7 ref.

Descriptors: *Heavy metals, *Plants, *Poisons, Water pollution effects, Path of pollutants, Food chains, Trace elements, Plant physiology, Biochemistry.
Identifiers: *Mercury.

Plants growing in environments that have the normal small amounts of mercury probably seldom exceed 500 ppb mercury in their tissues. In environments that have significantly larger amounts of mercury because of the natural occurrence of mercury-bearing deposits, the plants may contain between 500 and 3,500 ppb mercury in their dried tissues. Much larger amounts of mercury may be found in plant samples as surficial residues or as deposits in the tissues as a result of intentional application of mercury compounds or from contamination. (See also W71-02886) (Knapp-USGS)
W71-02893

MERCURY IN THE ATMOSPHERE,
Geological Survey, Washington. D.C.
J. H. McCarthy, Jr, J. L. Meuschke, W. H. Ficklin, and R. E. Learned.
In: Mercury in the Environment, Geological Survey Professional Paper 713, p 37-39, 1970. 3 p, 3 fig, 7 ref.

Descriptors: *Trace elements, *Heavy metals, *Poisons, *Path of pollutants, *Air pollution, Geochemistry, Air circulation, Altitude, Winds, Volatility, Chemical reactions.
Identifiers: *Mercury.

Mercury in the atmosphere is derived from surface rocks and soils and from continuing hypogene and supergene processes. Elemental mercury results from either process, and owing to its relatively high vapor pressure, it is released to the atmosphere. More mercury is found in air over mercury deposits than elsewhere, and the rate of release of mercury over the deposits is determined by barometric pressure and temperature. The maximum content of mercury in air was found near midday; lesser amounts were found in the morning and evening; and minimum amounts were found near midnight. Background concentrations of mercury in air at 400 feet above ground in the Southwestern United States range from 3 to 9 ng/cu m. (See also W71-02886) (Knapp-USGS)
W71-02894

ATMOSPHERIC AND FLUVIAL TRANSPORT OF MERCURY,
Geological Survey, Washington, D.C.
E. A. Jenne.
In: Mercury in the Environment, Geological Survey Professional Paper 713, p 40-45, 1970. 6 p, 31 ref.

Descriptors: *Path of pollutants, *Heavy metals, Sediment transport, Winds, Streamflow, Water chemistry, Biochemistry, Chemical reactions, Solubility, Food chains, Solutes.
Identifiers: *Mercury.

Mercury enters the atmosphere in both gaseous and particulate forms. The mobility of mercury is greatly enhanced by a property which is unique among the metals, namely the relatively high vapor pressure of the metallic state and, to a lesser extent, certain of its compounds. Gaseous and particulate mercury are commonly contained in the exhaust fumes from various industrial and smelting processes. Presumably, the microbial methylation of mercury will increase the vapor phase loss of mercury. Where streams have incised mercury-bearing deposits, both solute and particulate mercury are released directly to the fluvial environment. In places, thermal springs, nonthermal springs, and mine drainage contribute significant amounts of mercury to streams. Mercury is being continuously removed from the atmosphere and deposited on the earth's surface by dry fallout and by rainfall. Solute mercury introduced into streams is quickly transformed to the particulate form by reduction to metallic mercury, by sorption on to inorganic sorbates, by complexation with nonviable particulate organics, and by sorption and ingestion by viable biota. (See also W71-02886) (Knapp-USGS)
W71-02895

ANALYTICAL METHODS FOR DETERMINATION OF MERCURY IN ROCKS AND SOILS,
Geological Survey, Washington, D.C.
F. N. Ward.
In: Mercury in the Environment, Geological Survey Professional Paper 713, p 46-49, 1970. 4 p, 15 ref.

Descriptors: *Pollutant identification, *Trace elements, *Heavy metals, *Poisons, *Water pollution sources, Industrial wastes, Solutes, Chemical wastes, Analytical techniques, Neutron activation analysis, Chromatography, Colorimetry, Flame photometry, Surveys, Geochemistry, Reviews.
Identifiers: *Mercury.

The mercury content of most uncontaminated solid earth materials is between 10 ppb and 500 ppb, and for water resources, generally is less than 0.1 ppb. To be useful, any analytical method must be at least sensitive enough to detect as little as 10 billionths of a gram and in some analyses one or two orders of magnitude less. Using the best applicable methods, analytical limitations of the methods are 10 ppb for rock and soils and 0.1 ppb for aqueous solutions if 100 ml of sample is used. An exception to this statement is the neutron activation method which may reach 0.05 ppb for water and sediment samples. Among the applicable techniques, including kinds of separations as well as final measurements, are those based on molecular and atomic absorption, molecular and atomic emission, catalysis, nephelometry, polarography, and activation to produce measurable decay products. Emphasis is on procedures used by the U. S. Geological Survey. Dithizone forms a highly colored and extractable species with Hg. As little as 0.012 microgram Hg per square centimeter gives a measurable absorbance. The dithizone reaction is the basis of the first practicable field method for determining traces of mercury. (See also W71-02886) (Knapp-USGS)
W71-02896

DRAINAGE AND POLLUTION FROM BEEF CATTLE FEEDLOTS,
Cornell Univ., Ithaca, N.Y., Dept. of Civil Engineering.
Raymond C. Loehr.
ASCE Proceedings, Journal of the Sanitary Engineering Division, Vol 96, No SA 6, Paper 7726, p 1295-1309, December 1970. 15 p, 4 fig, 1 tab, 26 ref.

Descriptors: *Water pollution sources, *Cattle, *Farm wastes, *Confinement pens, Drainage, Rainfall, Runoff, Surface waters, Groundwater, Sanitary engineering, Pollution abatement.
Identifiers: *Feedlots, *Beef cattle feedlots.

Growth has taken place in the size of operations producing beef cattle for slaughter and in the water contamination problems associated with the drainage from feedlots. Data are presented on the quality and quantity of runoff that can occur at a feedlot. Runoff contains high concentrations of pollutants and occurs as a slug load on the resources of a stream. Because of the intermittent nature of the runoff, minimum control using retention ponds is possible. At a feedlot, major fraction of rain becomes runoff. Runoff coefficients of greater than 0.88 are shown. Groundwater pollution is another problem, and is discussed briefly. (Woodard-USGS)
W71-02902

MOVEMENT OF BACTERIA FROM A RIVER TO A MUNICIPAL WELL--A CASE HISTORY,
Geological Survey, Albany, N.Y.
Allan D. Randall.
Journal American Water Works Association, Vol 62, No 11, Part 1, p 716-720, November 1970. 5 p, 5 fig, 4 ref.

Descriptors: *Path of pollutants, *Induced infiltration, Coliforms, Alluvial channels, Dredging, Excavation, Aquifers, Gravels, Aquitards, Pumping, Water wells, Municipal water, Surface-groundwater relationships, Groundwater movement.
Identifiers: *Susquehanna River (NY), Binghamton (NY).

Coliform bacteria regularly travel at least 180 ft to municipal well from a reach of the Susquehanna River (NY) polluted by sewage. Excavation of the riverbed, in an area already geologically favorable for induced infiltration, seems responsible for bacteria reaching the well, after 19 yr of trouble-free operation. The well produces from beds of coarse sand and gravel and 10 to 80 ft below land surface. From 1945 through 1964 it was in daily use, with only occasional interruptions due to equipment failure, supplying 1.0 to 1.6 mgd of good water. (Knapp-USGS)
W71-02909

DISPERSAL OF PLATING WASTES AND SEWAGE CONTAMINANTS IN GROUNDWATER AND SURFACE WATER, SOUTH FARMINGDALE - MASSAPEQUA AREA, NASSAU COUNTY, NEW YORK,
Geological Survey, Washington, D.C.
N. M. Perlmutter, and Maxim Lieber.
For sale by Superintendent of Documents, US Government Printing Office, Wash, DC 20402. Geological Survey Water-Supply Paper 1879-G, 1970. 67 p, 10 fig, 5 plate, 9 tab, 30 ref.

Descriptors: *Path of pollutants, *Groundwater movement, *Industrial wastes, *Chromium, *New York, Dispersion, Mixing, Heavy metals, Surveys, Surfactants, Hydrogeology, Aquifers, Water quality, Recharge, Data collections, Hydrologic data.
Identifiers: *Plating wastes, *Nassau County (NY).

Plating wastes containing cadmium and hexavalent chromium have seeped down from disposal basins into the upper glacial aquifer of Nassau County, N. Y. intermittently since 1941. This seepage has formed a plume of contaminated water about 4,300 feet long, 1,000 feet wide, and 70 feet thick. The plume extends downgradient to the headwaters of Massapequa Creek, a small stream which forms a natural drain for part of the contaminated groundwater, while the remainder moves slowly downgradient as underflow beneath and parallel to the stream channel. The maximum observed concentration of hexavalent chromium in the groundwater was about 40 milligrams per liter in 1949, but since the start of Chromium-treatment operations in 1958, concentrations of chromium have deceased to less than 5 mg/liter in most of the plume. No public-supply wells have been contaminated by metal-plating wastes. Natural velocity and direction of the groundwater movement account for most of the longitudinal spread, and the pattern and rate of injection of the plating wastes and the heterogeneity of the deposits account for most of the lateral spread of the contaminants. The vertical extent of the contaminants is controlled chiefly by the head relations at and near the disposal basins, the vertical permeability of the beds, and the natural regional flow pattern. (Knapp-USGS)
W71-02922

FIFTY ENVIRONMENTAL PROBLEMS OF TIMELY IMPORTANCE,
Rand Corp., Santa Monica, Calif.
L. M. Libby.
Available from NTIS as AD-712 722, $3.00 in paper copy, $0.95 in microfiche. Report P-4415, Sept 1970. 67 p.
Identifiers: *Environment, Corrections, *Air pollution, Reviews, *Water pollution, Problem solving, Supersonic flight, DDT, Urban planning, Respiratory diseases, Radioactive waste, Carbon dioxide, Disposal, Wastes (Industrial), Sewage, Lead, Law, Climatology, Helium, Transportation, Arctic regions, Mining engineering, Oceans, Echinodermata, Ice fog, Carbon monoxide, *Environmental surveys, *Thermal pollution, *Oil pollution, Smog, Weather modification, Petroleum pipelines, Strip mining, Eutrophication, Starfishes, Domes (Structural forms.

The paper surveys some of the most recognizable and pressing problems of the environment, and includes comments on them from the current literature. Topics include short articles on pollution involving SST and stratospheric Air Force planes, heat, DDT, Airports, Design of satellite-city systems, Respiratory diseases, and smog, Radioactive waste disposal methods, Constructive use of garbage, Indemnity payments by air polluters, Phosphorus in waste waters, Constructive use of sewage, Biologic effects of lead, Clean-up of fuel oil, Weather modification, Ocean pollution, Reuse of golf courses, graveyards, and railroad properties, City slums, Resources of continental shelves, Hot pipeline in arctic, Los Angeles and earthquakes, Weather and CO2, Dome over Manhattan, Exter-

mination genus rattus, Helium, Eutrophication, Law for pollution control, Atmospheric CO, Starfish and its control, Oil spills, Logging, Tundra lands, and Ice fog.
W71-02953

THE PERSISTENCE AND ANALYSIS OF ORGANOCHLORINE INSECTICIDES IN SOILS AND SEDIMENTS,
Wisconsin Univ., Madison. Dept. of Soil Science.
For primary bibliographic entry see Field 05A.
W71-02979

RADIOACTIVITY AND A PROPOSED POWER PLANT ON CAYUGA LAKE.
Citizens Committee to Save Cayuga Lake, Ithaca, N.Y.

Citizens Committee to Save Cayuga Lake, Ithaca, New York, 1968. 16 p, 1 fig, 2 tab, 28 ref.

Descriptors: *Radioactivity, *Powerplants, *New York, Nuclear powerplants, Radioactive wastes, Uranium radioisotopes, Cooling, Gamma rays, Iodine radioisotopes, Strontium radioisotopes, Tritium, Gases, Cobalt, Cesium, Water quality, Genetics, Radiation.
Identifiers: *Cayuga Lake (N Y), Beta particles, Plutonium, Krypton radioisotopes, Xenon, Barium radioisotopes, Concentration factors.

The Citizens' Committee to Save Cayuga Lake was formed to protect their environment from radioactive waste contamination. The proposed Bell Station (nuclear power plant) is of such capacity and precise design not duplicated elsewhere and the proposed site is relatively small, slow-flushing Cayuga Lake (N Y). Radionuclides in quantities below AEC-established maxima will routinely be discharged into the atmosphere and lake, to be concentrated by aquatic organisms, and probably further concentrated in localized areas by currents, eddies, and winds. Radiation exposure of every person using the lake will be slightly increased by normal operation of the plant. It is possible to reduce or prevent routine discharges of radionuclides to the environment if operational procedures proposed by the company were revised. The local population has not been informed of the risks to itself and its environment inherent in operation of Bell Station or of costs necessary to avoid some of those risks. The utility should provide the public with estimates of risks involved in normal operation and an estimate of injury and property damage resulting from a serious accident. (Jones-Wisconsin)
W71-03025

COPPER IONS AS POISON IN THE SEA AND IN FRESHWATER,
Copenhagen Univ., Hillerod (Denmark). Freshwater Biological Lab.
E. Steemann Nielsen, and S. Wium-Andersen.
Marine Biology, Vol 6, No 2, p 93-97, 1970. 4 fig, 20 ref.

Descriptors: *Copper, *Ions, *Poisons, *Sea water, *Fresh water, Algae, Photosynthesis, Organic matter, Plankton, Chelation, Carbon radioisotopes, Chlorella, Growth rates, Diatoms, Phytoplankton, Toxicity, Iron, Light, Hydrogen ion concentration.
Identifiers: Chlorella pyrenoidosa, Nitzschia palea, Skeletonema costatum.

During the last two years intensive experimental work has been applied in investigations of the influence of ionic copper on photosynthesis and growth of green alga, Chlorella pyrenoidosa and the diatom, Nitzschia palea. Copper in ionic form is found to be very toxic to photosynthesis and growth of unicellular algae at concentrations usually found in natural waters, indicating that copper is not ordinarily present in ionic form but is complexed by organic matter such as polypeptides. The affinity of copper to diethyl-dithiocarbaminate is very much higher than to the organic matter which complexes copper in nature, thus it is not possible to distinguish the two forms of copper during analysis. Complexed copper is not poisonous to algae. It has recently been shown that ocean water in the centers of upwelling becomes suitable for plankton growth only after the addition of a chelator, suggesting that a large part of the copper found in subsurface waters of oceans is present in ionic form. Some manufacturers of carbon-14 ampoules have used ordinary distilled water which often has a content of about 250 micrograms copper per liter; thus, it is probable that some productivity measurements have been influenced. (Jones-Wisconsin)
W71-03027

TRANSPORT OF ORGANIC INSECTICIDES TO THE AQUATIC ENVIRONMENT,
Washington State Univ., Pullman.
E. Hindin, and P. J. Bennett.
Fifth International Water Pollution Research Conference, San Francisco, July 26-August 1, 1970. Preprint, 16 p, 9 tab, 17 ref.

Descriptors: *DDT, *Pesticide residues, *Pesticide drift, *Pesticide kinetics, Chlorinated hydrocarbon pesticides, On-site investigations, Columbia River Basin, Soil analysis, Water analysis, Gas chromatography, Silts, Analytical techniques, *Irrigation water, Absorption, Drainage effects, Drainage water, *Surface runoff, *Persistence, Organophosphorus pesticides, Water pollution sources.
Identifiers: DDD, DDE, *Ethion, *Pesticide transport, *Setteable silt.

A five-year study was undertaken to assess quantitatively the amount of DDT and ethion removed from a treated plot. Persistent insecticides such as DDT applied to the soils were found to be carried over in the soil from one growing season to the next, although the quantity was greatly diminished. Less conclusive evidence was found for the organophosphorus pesticide, ethion. Surface drainage has the ability to dissolve and carry (by absorption) insecticides in a suspension for great distances. The quantity of insecticides transported away via the surface drainage and water-borne settleable silt was extremely small compared to the amount of each insecticide residing in the soil. The authors stress the point that DDT will remain in the soil and thus in the surface drainage for many years. (Sjolseth-Washington)
W71-03093

OIL SLICK MOTION NEAR CHESAPEAKE BAY ENTRANCE,
Virginia Inst. of Marine Science, Gloucester Point.
John C. Munday, Jr., Wyman Harrison, and William G. MacIntrye.
Water Resources Bulletin, Vol 6, No 6, p 879-884, November-December 1970. 6 p, 2 fig, 1 tab, 19 ref.

Descriptors: *Oily water, *Path of pollutants, Fuels, Winds, Tides, Currents (Water), Tracking techniques, Movement, Water pollution sources, Water pollution effects.
Identifiers: *Chesapeake Bay, *Oil slicks.

Five-to-50-gallon slicks of No. 6 (Bunker C) fuel oil were tracked near Chesapeake Bay entrance for several hours on six different occasions. Slick motion was due mainly to surface currents. The slick wind factor varied with wind speed, showing a threshold at seven knots and approaching 2.0% at 20 knots. Published values of 2.3 to 5% did not exclude the effects of wind-generated surface currents. Prediction of slick motion using wind and published tidal-current data was deficient; accuracy will require extensive wind and surface-current time-series data. (Knapp-USGS)
W71-03123

SCHLICHTRULL V MELLON-POLLOCK OIL CO (NEGLIGENT DRILLING OF OIL WELL ALLEGED TO HAVE CAUSED SALINE WATER INTRUSION).
For primary bibliographic entry see Field 06E.
W71-03230

UNITED STATES V FLORIDA POWER AND LIGHT CO (THERMAL POLLUTION OF BISCAYNE BAY).
For primary bibliographic entry see Field 06E.
W71-03260

THE COLOMBO (DISCHARGE OF OIL INTO NAVIGABLE WATERS).
For primary bibliographic entry see Field 06E.
W71-03274

THE MERCURY POLLUTION PROBLEM IN MICHIGAN AND THE LOWER GREAT LAKES AREA (A SUMMARY OF INFORMATION AND ACTION PROGRAMS),
Michigan Water Resources Commission, Lansing.
For primary bibliographic entry see Field 05G.
W71-03294

5C. Effects of Pollution

RELATIVE TOXICITIES OF SELECTED CHEMICALS TO SEVERAL SPECIES OF TROPICAL FISH,
Hawaii Univ., Honolulu. Water Resources Research Center.
Jerry H. Nunogawa, Nathan C. Burbank, Jr., Reginald H. F. Young, and L. Stephen Lau.
Available from NTIS as PB-196 312, $3.00 in paper copy, $0.95 in microfiche. Technical Report No 40, August 1970. 38 p, 14 tab, 6 fig, 35 ref. OWRR Project A-018-HI (1).

Descriptors: Bioassay, *Toxicity, *Insecticides, *Fish toxins, Tilapia, Fish, Toxins, DDT, Dieldrin, Phenols, *Hawaii, Water pollution effects.
Identifiers: Near-shore fish, Mosquito fish, Guppies, *Tropical fish, Aholshole, Nehu, Lindane.

This study determined the 24, 48, 96-hour median tolerance limit of phenol, DDT, dieldrin, and lindane of five species of fish commonly found in streams and estuaries in semi-tropical areas. They are: (1) Gambusia affinis - mosquito fish, (2) Lebistes reticulatus - guppies, (3) Tilapia mossambica - tilapia, (4) Kuhlia sandvicensis - aholehole, and (5) Stolephorus purpureus - nehu. Of the five species, Gambusia affinis had the highest tolerance to the toxic agents used in this study. Lebistes reticulatus and Tilapia mossambica had approximately the same sensitivity to DDT as well as dieldrin and lindane. Lebistes reticulatus had a higher sensitivity to phenol than Tilapia mossambica. Although Stolephorus purpureus, nehu, was highly sensitive, Kuhlia sandvicensis was most sensitive to all toxic agents used.
W71-02829

DDT IN A FRESHWATER MARSH: A SIMULATION STUDY,
Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.
L. L. Eberhardt, R. L. Meeks, and T. J. Peterle.
Available from NTIS as BNWL-1297, $3.00 in paper copy, $0.95 in microfiche. BNWL-1297, March 1970. 54 p, 9 tabs, 30 fig, 110 ref.
Identifiers: *Water pollution, DDT, *Ecology, *DDT, Tracer studies, Mathematical models, *Food chains, Chlorine 36.

A computer simulation model has been constructed to represent the dynamics of chlorine-36 labelled DDT in a Lake Erie marsh. An exponentially decreasing input function (representing release of DDT from the granular formulation in which it was applied) determines concentration in water, from which one- or two-compartment models represent the concentration in various forms of flora and fauna. Observational data on 10 plant species, 6 invertebrates, and 3 vertebrate species were modelled. Five species (a plant, an invertebrate species, and the 3 vertebrates) were used

for a food-chain simulation. The overall results generally suggest that simple models, of the kind used to study radionuclide transfer through food chains, will provide reasonably good representations of the behavior of DDT in food chains. Controlled experiments are needed to properly identify the components of a model, and that a number of questions about sampling methodology remain unanswered.
W71-02836

INFLUENCE OF MINERALS ON SR90 AND CS137 UPTAKE BY BEAN PLANTS,
California Univ., Los Angeles. Lab. of Nuclear Medicine and Radiation Biology.
H. Nishita, R. M. Haug, and M Hamilton.
Soil Science, Vol 105, No 4, April 1968, p 237-243. 4 tab, 3 fig, 19 ref.

Descriptors: *Soil contamination, *Water pollution sources, *Radioactive wastes, *Fallout, *Absorption, Soil-water-plant relationships, Stontium radioisotopes, Cesium, Beans, Bentonite, Illite, Kaolinite, Soil chemical properties, Soil physical properties, Radioisotopes, Hazards, Leaves, Crop production, Soil amendments, Loam, Calcium, Potassium, Cation exchange, Plant physiology, Treatment.
Identifiers: *Radioactive materials, *Dispersed radionuclides, *Radiological hazard control, Clinoptilolite, Verxite, Vermiculite, Bauxite.

One of the problems with biosphere contamination with radioactive materials is contending with dispersed radionuclides at biologically hazardous levels. To minimize transfer of radionuclides along soil-water-plant-animal food chains leading to man, various methods of crop residue, and surface soil removal, plowing, soil amendments, and crop changes have been studied. This paper discusses the influence of addition of clinoptilolite, 'Verxite,' bentonite, illite, kaolinite, vermiculite and bauxite on Sr90 and Cs137 uptake by bean plants grown in two contaminated soils. Cs137 uptake was small compared to Sr90 uptake with all mineral treatments. Clinoptilolite had the greatest effect on both radionuclides. Sr90 uptake was significantly reduced while Cs137 uptake was increased. Effect of other minerals was nil; in no case was plant yield increased. Soil type is one of the important factors in radiological hazard control. Tables show soil and mineral properties, Cs137 and Sr90 activities with different treatments and ratios on leaves, and average bean weight after treatment. Figures of yield with mineral treatment, and uptake rates are shown. (Popkin-Arizona)
W71-02867

CHEMICAL, PHYSICAL AND BIOLOGICAL DYNAMICS OF NORTHERN PRAIRIE LAKES,
South Dakota State Univ., Brookings.
John G. Nickum.
Available from NTIS as PB-196 357, $3.00 in paper copy, $0.95 in microfiche. Completion Report, Water Resources Institute, South Dakota State University, Brookings, December 1970. 38 p, 3 tab, 10 fig, 23 ref. OWRR Project B-002-S DAK (4).

Descriptors: *Water quality, *Lakes, *Eutrophication, Phytoplankton, Plankton, Productivity, Primary productivity, Iced lakes, Ions, Sulfates, Carbonates, Bicarbonates, Diatonics, Cyanophyta, Algae, South Dakota, Water pollution effects, Water pollution sources, Cultivation.
Identifiers: Lake Herman (S. Dak), Enemy Swim Lake (S. Dak).

Water samples and samples of plankton were collected from Lake Herman and Enemy Swim Lake, both located in eastern South Dakota, from July, 1967 through June, 1970. All samples were analyzed for selected chemical characteristics and for phytoplankton population. Results indicated that both lakes are eutrophic but Lake Herman is considerably more productive than Enemy Swim. Concentrations of most ions were from 50 per cent to 100 per cent greater in Lake Herman than in Enemy Swim and phytoplankton populations were often 100 times more dense in Lake Herman. Relative abundance of major ions were similar in both lakes except that sulfate was the dominant anion in Lake Herman and bicarbonate - carbonate in Enemy Swim. Both lakes showed uniform chemical conditions from one sampling station to another and similar annual dynamics marked by a sharp increase to peak levels of all major ions under ice cover. Phytoplankton populations were dominated by blue-green algae in Lake Herman, and by diatoms in Enemy Swim. Numbers and kinds of algae varied from season-to-season and from year-to-year indicating that intensive long term sampling is necessary in any study of plankton dynamics in these lakes. The greater eutrophication of Lake Herman appears related to the intensive cultivation of its watershed.
W71-02880

MERCURY IN THE ENVIRONMENT.
Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 05B.
W71-02886

BIOLOGICAL FACTORS IN THE CHEMISTRY OF MERCURY,
Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 05B.
W71-02892

FIFTY ENVIRONMENTAL PROBLEMS OF TIMELY IMPORTANCE,
Rand Corp., Santa Monica, Calif.
For primary bibliographic entry see Field 05B.
W71-02953

STUDIES ON THE INTERACTIONS OF AQUATIC BACTERIA AND AQUATIC NEMATODES,
Auburn Univ., Ala. Water Resources Research Inst.
For primary bibliographic entry see Field 05G.
W71-03013

BIOGEOCHEMICAL MODELING OF EUTROPHIC LAKES FOR WATER QUALITY IMPROVEMENT,
Notre Dame Univ., Ind. Dept. of Civil Engineering.
For primary bibliographic entry see Field 05G.
W71-03021

NUTRIENTS AND QUALITY IN IMPOUNDED WATER,
Illinois State Water Survey, Peoria. Water Quality Section.
Wum-Cheng Wang, and Ralph L. Evans.
Journal American Water Works Association, Vol 62, No 8, p 510-514, 1970. 8 fig, 3 tab, 15 ref.

Descriptors: *Nutrients, *Water quality, *Impounded waters, Streams, Flow, Seasonal, Stratification, Nitrates, Silica, Ammonia, Phosphates, Runoff, Illinois, Hydrogen ion concentration, Alkalinity, Hardness (Water), Sampling, Diatoms, Nitrogen, Bacteria, Algae, Thermal stratification, Dissolved oxygen, Hypolimnion.
Identifiers: Lake Bloomington (Ill), Chemostratification.

An extensive study was made of impounded Lake Bloomington (Illinois), as significant changes occur in stream water quality when they are impounded. With few exceptions concentration of each constituent decreases with passage through the impoundment. Major influences within the system observed were stream flow, seasonal patterns, and stratification. Nitrate nitrogen and silica concentration increased with increasing stream flow. Ammonia-nitrogen and orthophosphate concentration were minimal. Since these constituents were principally derived from agricultural runoff the relative mobility of each in soil, appears clear. Nitrate nitrogen and phosphorus contributions to the water system represented 8.3% and 0.1%, respectively, of that applied to the drainage area. During warm weather, organic nitrogen concentrations were highest while nitrate-nitrogen was minimal, suggesting influence of biological activity. Difference between rate of nitrate-nitrogen and silica concentration reduction, though of the same origin, also suggested influence of biological uptake. Within the impoundment, stratification appeared the governing influence, as evidenced by changes in nitrate nitrogen and silica concentration with depth. Further insight into the interrelationships would appear to permit intelligent flexibility on the part of water works management. (Jones-Wisconsin)
W71-03028

RAPIDLY LABELED POLYPHOSPHATES AND METAPHOSPHATES IN THE BLUE-GREEN ALGA ANACYSTIS NIDULANS (IN GERMAN),
Technische Hochschule, Hanover (West Germany). Inst. for Botany.
For primary bibliographic entry see Field 07B.
W71-03033

SIMULATING THE EFFECT OF SINKING AND VERTICAL MIXING ON ALGAL POPULATION DYNAMICS,
Oregon State Univ., Corvallis. Dept. of Civil Engineering.
David A. Bella.
Journal Water Pollution Control Federation, Vol 42, No 5, Part 2, p R140-R152, 1970. 1 fig, 1 tab, 17 ref.

Descriptors: *Mathematical models, *Algae, *Population, Dynamics, Lakes, Dissolved oxygen, Nutrients, Cyanophyta, Mixing, Phytoplankton.
Identifiers: *Algal sinking, *Vertical mixing, Euphotic zone, Diffusion coefficient, Lake Sammamish (Wash).

The developed simulation model describes the combined effect of growth, sinking, and vertical mixing on dynamics of algal population of lakes. Small differences in sinking velocities may significantly increase the growth of algae. A lowering of sinking often leads to an invasion of a less objectionable phytoplankton. Vertical mixing increases the density of algae and may result in transformation of the entire community. Artifical mixing may serve as an aid in control of algae, but the homogenization of environment is apt to reduce the species diversity at all trophic levels. (Wilde-Wisconsin)
W71-03034

MOVEMENT OF PHOSPHATE AND OTHER IONS FROM AND THROUGH LAKE MUDS,
Waterloo Univ. (Ontario). Dept. of Biology.
For primary bibliographic entry see Field 02H.
W71-03045

CULTURAL EUTROPHICATION: THE NATURE OF THE PROBLEM AND SOME RECOMMENDATIONS FOR ITS STUDY AND CONTROL,
Florida Univ., Gainesville. Dept. of Environmental Engineering.
Patrick L. Brezonik.
Department of Environmental Engineering, University of Florida, Gainesville, Undated. 26 p, 5 tab, 51 ref. OWRR Project B-004-FLA (2).

Descriptors: *Lakes, *Eutrophication, *Water pollution control, *Water pollution sources, *Water pollution effects, Water utilization, Analytical techniques, Nutrients, Nitrogen, Phosphorus, Agriculture, Water management (Applied), Geochemistry, Soil types, Hydrology, Climates, Trophic level, Nitrogen fixation, Forest, Winds, Light, Temperature, Hydrogen ion concentration, Dissolved oxygen, Chlorophyll, Algae, Conductivi-

ty, Sediments, Benthic fauna, Recreation, Bioassay, Fungi, Viruses.
Identifiers: *Cultural eutrophication, Trophic indicators, Nutrient budget.

The causal changes in water quality from pre-industrial man to present high-density populations are described. Of desirable techniques, mathematical models and bioassays make possible comparisons of the nutritional status of the different species of algae microscopically, by cytochemical staining of enzymes. The field of paleolimnology points out the differentiation of natural and cultural effects on lakes. Study of sediment cores gives a basis for comparison in eutrophication development. Bloom-forming blue-green algae characteristics point to need of knowledge of algal physiology. The best solution to the problem of cultural eutrophication is elimination of nutrients from source waters. In restoring lakes, methods of preventing nutrient release from sediments, and research on effectiveness of providing game fish spawning and feeding areas is needed. Refining the tools for lake management, including legal developments in shoreland corridor zoning are prerequisites. Greater accuracy is needed in predicting response of a lake to a given nutrient input or to changes in land utilization to make possible lake basin zoning and development of land use patterns on a rational basis. (Jones-Wisconsin)
W71-03048

THE EFFECT OF WATER QUALITY ON THE METABOLISM OF THE LACTIC STREPTOCOCCI,
Virginia Polytechnic Inst., Blacksburg. Dept. of Biology.
Robert E. Benoit.
Water Resources Research Center, Virginia Polytechnic Institute, Blacksburg, Bulletin 13, 1968. 64 p, 11 fig, 5 tab, 64 ref, append. OWRR Project A-005-VA (3).

Descriptors: *Water pollution effects, *Fermentation, *Lactobaccilus, Streptococcus, Cultures.
Identifiers: *Cheese industry, Streptococcus lactis, Streptococcus lactis var tardus 3.

The quality of water in certain parts of Virginia and neighboring states causes considerable difficulties in various microbial fermentations. This is particularly true of the cheese industry, because in the presence of water pollutants, the mutant cells of Streptococcus lactis selectively become the dominant lactic streptococci. These cells, designated as S lactis var tardus, have an impaired ability to ferment lactose and produce, besides lactic acid, considerable amounts of acetic and formic acids. This undesirable course of fermentation was precluded by deionization of water used in the preparation of microbial media, and also by rotation of starter cultures with cultures originated in different geographical regions. Analyses of growth curves, the pH changes, and the individual acid production on a lactose-yeast extract-phosphate medium permitted a differentiation of S lactis ATCC 11454 and var tardus 3. (Wilde-Wisconsin)
W71-03055

UTILIZATION OF ALKOXYSILANES FOR REDUCTION OF THE ABUNDANCE OF PHYTOPLANKTON DURING 'BLOOMS' OF WATER BASINS (IN RUSSIAN),
Moscow State Univ. (USSR).
For primary bibliographic entry see Field 05F.
W71-03056

EFFECTS OF CONTROLLED NUTRIENT DILUTION ON THE EUTROPHICATION OF A LAKE,
Washington Univ., Seattle. Dept. of Civil Engineering.
Ray T. Oglesby.
Eutrophication: Causes, consequences, corrective, p 483-493. Printing and Publishing Office, National Academy of Sciences, Washington, DC, 1969. 4 fig, 3 tab, 9 ref. FWPCA Grant No WPD 38-01 (RI).

Descriptors: *Eutrophication, *Lakes, Phosphorus, Nitrate, Nitrogen, Magnesium, Sodium, Alkalinity, Hardness (Water), Diversion.
Identifiers: Aphanizomenon, Anabaena, Gleotrichia, Green Lake (Wash), Dilution rate.

To decrease the level of eutrophication, the City of Seattle (Washington), diverted into neighboring Green Lake some of its municipal water. Since 1962 about 6.5 billion gallons have been flushed through the lake. In 1965-1966, the effect of this dilution was expressed in decrease of the total and orthophosphorus, nitrate nitrogen, magnesium, sodium, alkalinity, and total hardness, but an increase in calcium and potassium. With the exception of September and October, the water markedly improved its transparency. The virtual disappearance of the primary nuisance Aphanizomenon holsaticum and a reduction of Gleotrichia echinulata was partly offset by an increase in the relative abundance of Anabaena circinalis. (See also W70-03975) (Wilde-Wisconsin)
W71-03057

QUANTITATIVE ESTIMATION OF MIGRATORY FISH SURVIVAL UNDER ALTERNATIVE WATER QUALITY CONTROL PROGRAMS,
Federal Water Quality Administration, Edison, N.J.
A. R. Morris, and G. D. Pence.
Fifth International Water Pollution Research Conference, San Francisco, July 26-August 1, 1970. Preprint. 11 p, 8 fig, 3 tab, 15 ref.

Descriptors: Estimating, Fish management, Delaware River, Water pollution control, Statistical models, Anadromous fish, Water quality, Fishkill, Water pollution effects, Computer models, Fish migration, Dissolved oxygen, Mathematical model, Biochemical oxygen demand, Estuarine environment, Water quality control.
Identifiers: Shad, Alosa sapidissima, Dissolved oxygen model, Fish survival.

The objective of this study was to develop a reasonable and attainable management scheme to control pollution and enhance the water quality in the degrade portion of the Delaware River Estuary. Water quality levels for three hypothetical management schemes were given. Estimation of Alosa sapidissima survival under these schemes was made. The authors constructed a mathematical model describing quantitative changes of a variable of concern to water quality management. This gave estimates of the water quality to be expected during an entire year for each of the three pollution control programs. Data were collected on the physiological responses of migrating shad in the Delaware River. This permitted determination of the relationship between DO and shad survival. These data were used in the decision process leading to the Delaware River management scheme. (Sjolseth-Washington)
W71-03058

ENZYMIC MECHANISMS OF TEMPERATURE COMPENSATION: IMMEDIATE AND EVOLUTIONARY EFFECTS OF TEMPERATURE ON ENZYMES OF AQUATIC POIKILOTHERMS,
British Columbia Univ., Vancouver. Dept. of Zoology.
George N. Somero.
The American Naturalist, Vol 103, No 933, p 517-530, 1969. 3 fig, 3 tab, 31 ref.

Descriptors: *Enzymes, *Animal metabolism, Fish physiology, *Animal physiology, *Biochemistry, Crabs, Shrimp, *Activation energy, Thermal stress, Compensation, Acclimatization.
Identifiers: *Aquatic poikilotherms, *Evolutionary effects, *Enzymic reactions, Eelpout, Lactate dehydrogenase, Pyruvate kinase, Temperature effects, *Michaelis constant, Adaptation, *Enzyme-substrate affinity.

The following conclusions have been drawn about temperature effects on enzymes of aquatic poikilotherms: (1) Immediate compensation to temperature changes is promoted by an inverse relationship between temperature and enzyme-substrate affinity. (2) The sharp decreases in enzyme-substrate affinity which frequently occur at the extremes of an organism's habitat temperature may be important in establishing thermal tolerance limits for the organism. (3) In evolutionary adaptation of enzymes to temperature, minimal Km values (maximal enzyme-substrate affinity) normally occur near the lower extreme of a species' adaptation temperature. However, evolutionary adaptation of enzymic rates does not appear to be effected by low absolute values of Km, and (4) Rate compensation to temperature, on an evolutionary time scale, is accomplished by activation energy changes, at least in the case of some enzymes. (Sjolseth-Washington)
W71-03060

MALATHION: CHRONIC EFFECTS ON ESTUARINE FISH,
Bureau of Commercial Fisheries, Gulf Breeze, Fla. Biological Lab.
H. T. Holland, and Jack I. Lowe.
Mosquito News, Vol 26, No 3, p 383-385, September 1966. 5 ref.

Descriptors: Organophosphorus pesticides, Inhibition, Growth rates, Mortality, Enzymes, Pesticide toxicity, Fish physiology, Animal pathology.
Identifiers: *Malathion, Spot fish, *Leiostomus xanthurus, Brain cholinesterase, Enzyme activity, Recovery, Osmoregulation, Salinity tolerance.

Juvenile Leiostomus xanthurus were exposed to 10 ppb. malathion for 26 weeks. One group served as a control. Neither group of fish exhibited symptoms of distress nor did the two lots differ significantly in growth or mortality. Brain cholinesterase was significantly lower in the experimental group, stabilizing at approximately 70 percent of normal. This inhibition appeared to have no adverse effects on the fish. No differences in reactions between experimental and control groups when they were transferred from 2.8 percent salinity water to water of 1.5 percent salinity. There was no gross pathology of the gonads in the exposed fish. (Katz-Washington)
W71-03061

EFFECTS OF PROLONGED EXPOSURE TO SEVIN ON AN ESTUARINE FISH, LEIOSTOMUS XANTHURUS LACEPEDE,
Bureau of Commercial Fisheries, Gulf Breeze, Fla. Biological Lab.
Jack I. Lowe.
Bulletin of Environmental Contamination and Toxicology, Vol 2, No 3, p 147-155, 1967. 8 ref.

Descriptors: *Carbamate pesticides, Pesticide toxicity, Bioassay, *Animal pathology, *Enzymes, Salinity, Growth rates, Mortality, Inhibition, Fish physiology.
Identifiers: *Sevin, *Leiostomus xanthurus, Spot fish, Osmoregulation, *Histopathology, Salinity tolerance, Central nervous system lesions, Enzyme activity, Brain chlorinesterase.

Leiostomus xanthurus were exposed to 0.1 ppm Sevin (a carbamate pesticide) for five months. Fish surviving this chronic exposure were examined histopathologically. Other survivors were subjected to drastic salinity changes to test their osmoregulatory ability. Mortality and growth rates in control and experimental were comparable. Chronically exposed fish showed some incidence of central nervous system lesions, although these could not be attributed to exposure to Sevin. No abnormal inhibition of brain cholinesterase was observed in the experimental group. Exposed and unexposed fish were subjected to rapid increases and decreases in salinity. No differences in reactions between exposed and unexposed fish were noticed. (Katz-Washington)
W71-03062

EMBRYONIC DEVELOPMENT OF THE PIKE (ESOX LUCIUS L.) WHEN INCUBATED UNDER DIFFERENT OXYGEN CONDITIONS,
Akademiya Nauk SSSR, Moscow. Inst. of Animal Morphology.
M. V. Gulidov.
Voprosy Ikhtiologii, Vol 9, No 6, p 841-851, 1969. 4 tab, 1 fig, 34 ref.

Descriptors: *Embryonic growth stage, Pikes, Incubation, Laboratory tests, *Oxygen requirements, Oxygenation, *Lethal limit, Water pollution effects, Dissolved oxygen, Mortality, Hatching, Viability, Fish eggs, Fishkill.
Identifiers: Oxygen conditions, *Threshold oxygen concentrations, Esox lucius, *Abnormal development.

Experimental data are presented on the effect of oxygen conditions on the development of the pike. Upper and lower threshold concentrations of oxygen are established. The lower threshold oxygen concentration is apparently 1.8 mg./l. The upper threshold oxygen concentration is between 39.5 and 45.3 mg./l. There is shown to be a pattern in the variation in mortality during incubation of the eggs and the number of individuals hatched when oxygen content is varied in the range between the upper and lower threshold concentration, and qualitative features of the development of the embryos are also established. (Sjolseth-Washington)
W71-03064

EFFECT OF OXYGEN ON GROWTH AND FOOD CONVERSION EFFICIENCY OF NORTHERN PIKE,
Minnesota Univ., St. Paul. Dept. of Entomology, Fisheries and Wildlife.
Ira R. Adelman, and Lloyd L. Smith.
The Progressive Fish-Culturist, Vol 32, No 2, p 93-96, 1970. 2 tab, 3 figs, 5 refs.

Descriptors: *Dissolved oxygen, *Growth, *Food Conversion efficiency, Food consumption rates, *Northern pike, Temperature, Hydrogen Ion concentration, Length, Weight, Water pollution effects.
Identifiers: *Fathead minnows, MS-222.

Two laboratory experiments on Northern pike (Esox lucius) were conducted to determine the effect of varied oxygen concentrations on growth rate food consumption, and food conversion efficiency. An apparatus for rearing juvenile pike under various concentrations of dissolved oxygen was prepared. Pike were fed fathead minnows (Pimephales promelas) daily. Both experiments showed a gradual decrease in growth rate as the oxygen was reduced to 3 or 4 ppm and then a quick decrease below that level. (Wahtola-Washington)
W71-03089

EFFECTS OF THE INSECTICIDE SEVIN ON SURVIVAL AND GROWTH OF THE COCKLE CLAM CLINOCARDIUM NUTTALLI,
Oregon State Univ., Corvallis. Dept. of Fisheries and Wildlife.
Jerry A. Butler, Raymond E. Millemann, and Nelson E. Stewart.
U. S. PHS Grant No. CC 00303. Journal of the Fisheries Research Board of Canada, Col 25, No 8, p 1621-1635, 1968. 6 tab, 2 figs, 20 refs.

Descriptors: *Water pollution effects, *Insecticides, *Survival and growth, *Cockle clam, Sea water, Food consumption, Juvenile clams, Temperature.
Identifiers: *Sevin, *Mollusca, No 1-napthol, *Clinocardium nuttalli, *TLm's.

Experiments are reported on the effects of the insecticide, Sevin, and its hydrolytic product, 1-napthol, on the survival, growth, and food consumption of larval and juvenile cockle clams (Clinocardium nuttali). Clams were tested in standing sea water at a salinity of 25% and a temperature of 19 .. 2.0C, and were fed cultures of the unicellular alga Monochryis lutheri. Algal cell concentrations ranged from 10,000 to 200,000 cells per ml of test solution. Toxicant concentrations ranged from 0.1 to 10.0 mg/liter. Larvae exposed to Sevin concentrations of 0.8 mg/liter were dead by day 7 of the test, and the growth of those exposed to 0.4 mg/liter was reduced by 15%. The growth of juvenile clams was reduced more by 1-napthol than by Sevin. The food consumption of juvenile clams exposed to 1.6 mg/liter of Sevin was markedly reduced and their food conversion efficiency was impaired. Adult clams exposed to Sevin concentrated the toxicant in their tissues. Clams exposed at 11C concentrated more toxicant than those exposed at 20C. Tissue concentrations of toxicant decreased sharply after the clams had been in clean sea water for 12 hr. (Wahtola-Washington)
W71-03090

BEHAVIORAL RESPONSES TO ELECTROLYTES IN THE CRAYFISH, PROCAMBARUS CLARKII,
Texas Univ., Austin. Dept. of Zoology.
Mary W. Pocock, and James L. Larimer.
Physiological Zoology, Vol 41, No 3, p 332-340, 1968. 21 ref, 4 tab, 2 fig. NIH Grant NB-05423.

Descriptors: *Animal behavior, *Electrolytes, Crayfish, *Animal physiology, *Ions, Inhibition, Laboratory equipment, Sodium chloride, Potassium compounds, Calcium chloride, Magnesium compounds, Biochemistry, Ventilation, Water pollution effects.
Identifiers: Procambarus clarkii, *Responses, *Ion interaction, EKG, Lithium, Strontium, Barium, Acetates, *Heart response, Ion stimulation.

A behavioral test involving reflex cardiac and ventilation responses has been employed in indexing chemospecificity to electrolytes in the crayfish. 23 solutions, composed of various combinations of seven cations and five anions were tested on 33 animals. Ion stimulation did not in every case evoke reflex inhibition of both homolateral ventilation frequency and the heart. Solutions of divalent cations excite ventilation frequency, amplitude, or both; however, no pattern is discernible for the animals' heart responses. Monovalent cations inhibit ventilation, regardless of the anion present. A definite pattern of heart responses is seen to distinguish monovalent chlorides from monovalent nitrates. With chlorides, bilateral inhibition of ventilation is required in order to evoke the heart response. Monovalent nitrates evoke cardiac inhibition regardless of the heterolateral response. Preliminary results indicate the possibility of ion interaction in the form of an anesthetic effect of MgCl sub 2. Cationic versus anionic effects and the number of possible receptor sites have been discussed. (Katz-Washington)
W71-03091

TOXICITY OF PCP FOR THE 'DOJO' FISH, MISGURNUS ANGUILLICAUDATUS (CANTOR), WITH SPECIAL REFERENCE TO THE RELATION BETWEEN CONCENTATION AND IMMERSION TIME. STUDIES ON THE BIOLOGICAL ASSAY OF CHEMICALS IN FISHES (IN JAPANESE),
Ihara Agricultural Chemicals Inst., Shimizu (Japan).
V. Sumio Nagasawa, and Michiyo Shiba.
English Summary. Jap J Appl Ent Zool Vol 13, 47-51, 1969. 3 fig, 3 tab, 5 ref.

Descriptors: *Bioassay, Phenols, *Toxicity, *Regression analysis, *Statistics equations, Water pollution effects.
Identifiers: *PCP, Dojo fish, Misgurnus anguillicaudatus, Immersion time, Chi-square test.

Toxicity of PCP for the 'Dojo' fish, Misgurnus anguillicaudatus (Cantor), with special reference to the relation between concentration and immersion time. Studies on the biological assay of chemicals in fishes. In this paper, the toxicity of PCP-Na for the 'Dojo' fish was discussed through results obtained by a regression method, taking into consideration the immersion time of the fish and the concentrations of the testing solution. Immersion time in the testing solution was controlled by washing the whole test vial, including the fish, in running water. From the data of 87 combinations of concentrations (ppm) per weight (g) of fish C and time of immersion T (min.), together with indications of whether or not the fish responded, an equation for fitting a probit regression plan was estimated as: Y-— - 5.1725..3.3485xsub 1 ..5.6678xsub 2. Here x sub 1 and x sub 2 are log C and log T, respectively and Y is the probit probability of response P. Results of the X sq test showed no significant difference between the empirical probits and the predictions from the fitted equation. The 5% fiducial limit curves (t—1.96) for P—0.5 and 0.9 were calculated and were shown in the figures. (Katz-Washington)
W71-03092

TRANSPORT OF ORGANIC INSECTICIDES TO THE AQUATIC ENVIRONMENT,
Washington State Univ., Pullman.
For primary bibliographic entry see Field 05B.
W71-03093

POLLUTION OF THE NORTH SEA AND REARING EXPERIMENTS ON MARINE PHYTOFLAGELLATES AS AN INDICATION OF RESULTANT TOXICITY,
H. Kayser.
Fifth International Water Pollution Research Conference, San Francisco, July 26-August 1, 1970. Preprint, 7 p, 5 fig, 5 ref.

Descriptors: *Water pollution effects, Water pollution sources, Industrial wastes, Domestic wastes, Dinoflagellates, *Laboratory tests, Cultures, *Growth rates, Plant growth regulators, Plant growth substances, Algae, Iron, Bioassay, Bioindicators, Food chains, Titanium, Plant populations, Toxicity.
Identifiers: *North Sea, Prorocentrum micans, Ceratium furca, Turbidostat cultures.

The extreme pollution of the North Sea was described. Since this trend is likely to continue, the author developed methods for determination of the possible biological consequences. This method involves the culture of primary producers, namely dinoflagellates, in waste waters. Mass cultures provided information about the growth rate and maximum density of populations under the influence of waste water. This method is able to indicate the sublethal influences on characteristic members of the marine food chain. It is hoped that further advancement of the test method will allow calculation of the sublethal level of waste water discharge into the North Sea. (Sjolseth-Washington)
W71-03095

GENERAL LIMNOLOGICAL AND BIOLOGICAL STREAM SURVEYS AS A SIMPLE MEANS OF DETECTING POLLUTION AND CONTROLLING THEIR EFFECTS,
Landesstelle fuer Gewasserkunde, Karlsruhe (West Germany).
For primary bibliographic entry see Field 05A.
W71-03096

DEVELOPMENT OF A GROSS TOXICITY CRITERION IN SAN FRANCISCO BAY,
Engineering-Science, Inc., Arcadia, Calif.; and California Univ., Berkeley.
N. E. Armstrong, P. N. Storrs, and E. A. Pearson.
Fifth International Water Pollution Research Conference, San Francisco, July 26-August 1, 1970. Preprint, 15 p, 10 fig, 1 tab, 14 ref.

Descriptors: Waste dilution, *Water quality act, *Bioassay, Lethal limit, Toxicity, *Water quality control, On-site investigations, On-site data collections, *Water quality, Biochemical oxygen demand, *Dispersion, Estuarine environment, Correlation analysis, Waste disposal, Mathematical models, California, Water pollution effects.

Identifiers: *San Francisco Bay, TLm, *Toxicity criteria, Benthic animal diversity.

The development is discussed of a relationship between the waste constituent, toxicity, and a measure (the diversity index) of the structure of a portion of the ecological community. These data would produce a rational approach for developing water pollution control design criteria which would protect the aquatic biota for desired uses. Methods for estimating the concentration of relative toxicity at any location in the receiving water were given. Correlation studies were conducted to develop cause and effect relationships between waste discharges and biological effects. The data indicated that damage will be done to the benthic fauna in those areas where the relative toxicity is not diluted to 40 ml./l or by a factor of 25, i.e., the water quality criterion that a waste discharge must receive a 25 to 1 dilution of its relative toxicity was established. (Sjolseth-Washington)
W71-03097

KINETICS OF PESTICIDES IN NATURAL MARSH ECOSYSTEMS,
Federal Water Pollution Control, Washington, D.C.
James O. Keith, Donald B. Knapp, and William C. Johnson.
Annual Progress Report, Bureau of Sports Fisheries and Wild Life, Wildlife Research Work Unit, Denver Wildlife Research Center, 1967. 48 p, 12 fig, 12 tab, 9 ref.

Descriptors: *Pesticide residues, Irrigation water, *Pesticide kinetics, Water pollution effects, *Freshwater marshes, Persistence, Oregon, Pesticide drift, *Pesticide toxicity, *On-site data collections, On-site investigations, Aquatic environment, *Water birds, Gulls, Gas chromatography, DDT, Dieldrin, Endrin, Aldrin, Waste analysis, Benthos, Aquatic populations.
Identifiers: Dursban, *Tule Lake, Grebes, Coots, Egrets, Terns, Chubs, DDD, DDE, Toxaphene, Heptachlor epoxide, Chlordane, Lindane, BHC, Kelthane, Thiodan, *Biomagnification.

Data on insecticide residues in birds and marsh habitats at Tule Lake Refuge between 1960 and 1967 were compiled. Results clearly show the seasonal impact on the marsh of contaminations in waste agricultural water, the biomagnification of residues, and the complex behavior and fate of insecticides in the marsh and in birds. Studies of Dursban persistence and effects in marsh habitats were investigated in Kern and Colusa Counties in 1967. Results are being prepared for publication. (Sjolseth-Washington)
W71-03098

THE EFFECT OF THREE COMMON POLLUTANTS ON THE RESPIRATION RATE OF TUBIFICID WORMS,
Eastern Illinois Univ., Charleston. Dept. of Zoology.
L. Stephen Whitley, and Richard A. Sikora.
Journal Water Pollution Control Federation, Part 2, p R57-R66, February 1970. 7 fig, 1 tab, 31 ref. NIH Grant No WP 00937-02.

Descriptors: Water pollution effects, *Respiration, *Tubificids, Sludge worms, *Phenols, Hydrogen ion concentration, Bioassay, Mortality, Toxicity, Animal metabolism, Industrail wastes.
Identifiers: *Nickel, *Lead, *Pentachlorophenol, *Respiration rate.

These data have shown the effects of lead, nickel, and pentachlorophenol to be regulated by the pH. The respiratory function of tubificids is affected very little by nickel, inhibited by lead, and stimulated by PCP. The lack of reaction to nickel concentrations would indicate little sensitivity to nickel inhibition of enzyme systems operating in tubificid respiration pathways. The effect of lead probably is due to mucous coagulation on the body wall inhibiting gaseous exchange. The effect of PCP of increasing respiration at higher pH levels would appear to be associated with its dual reaction of being considerably more toxic to pH levels below 8.5 and affecting respiration rate very little, and being less toxic at levels of 8.5 and higher and affecting respiration rate considerably. In each of the three experimental sets, however, the effect of an environmental factor, pH, on the relative effect of a pollutant is very clear. (Sjolseth-Washington)
W71-03099

THE DEVELOPMENT OF SOME BLACK SEA FISHES IN SEA WATER POLLUTED BY PETROLEUM PRODUCTS,
Akademiya Nauk URSR. Inst. of Biology of the Southern Seas.
O. G. Mironov.
Voprosy Ikhtiologii Vol 9, No 6, 919-922, 1969. 2 tab, 3 fig, 4 ref.

Descriptors: *Water pollution effects, *Oily water, Oil wastes, Fish eggs, Fishkill, Bioassay, Oil, Larval growth stage, *Mortality, Viability, Lethal limit.
Identifiers: *Oil pollution, Black Sea, Anchovy, Scorpion-fish, Sea-parrot, *Egg development stages, Petroleum, Black oil, Solar oil, *Survival, *Growth and development.

A study was made of the development of the fertilized eggs of Engraulis encrasicholus ponticus Alex., Scorpaena porcus L. and Crenilabrus tinca L. in sea water containing 0.1-0.001 ml/liter of petroleum, solar oil, and black oil. The different species sensitivity of the fishes to the petroleum products employed was clarified. A harmful effect of the substances selected (death of the organism) was clearly traced to a concentration of 0.001 ml/liter. It is suggested that lower concentrations of petroleum, solar oil and black oil will also be found to be toxic for the hydrobionts concerned. The consequences of such intoxication may not be revealed in the direct death of the eggs or prelarvae, but at later stages in development or in future generations. (Sjolseth-Washington)
W71-03100

MERCURY CONCENTRATIONS IN TISSUES OF FISH FROM THE SASKATCHEWAN RIVER,
Saskatchewan Univ., Saskatoon.
G. Wobeser, N. O. Nielsen, and R. H. Dunlop.
Journal Fisheries Research Board of Canada Vol 27, No 4, 830-834, 1970. 1 tab, 14 ref.

Descriptors: *Public health, Analytical techniques, *Heavy metals, Water pollution effects, Industrial wastes, Freshwater fish, On-site data collections, Suckers, Pikes.
Identifiers: *Mercury, Tissue analysis, *Saskatchewan River, Muscle tissue, Liver tissue, Kidney tissue, Canada.

Muscle tissue of 81 fish from several locations in the Saskatchewan River system contained an average of more than 1.0 ppm of mercury. Fish collected at two sites had much higher concentrations, with individual fish containing up to 11.2 ppm. The concentrations found were higher than those reported for fish from uncontaminated environments, and correspond to values reported for Scandinavian fish collected in areas of industrail pollution. (Sjolseth-Washington)
W71-03101

EFFECT OF RECENT ACIDIFICATION OF WATER ON THE PLANKTON ORGANISMS IN LAKE TOYA, HOKKAIDO (IN JAPANESE),
Hokkaido Univ., Sapporo (Japan). Plankton Lab.
Teruyoshi Kawamura.
English summary. The Japanese Journal of Limnology Vol 30, No 3, p 87-97, October 1969. 10 ref, 4 fig, 3 tab.

Descriptors: Water pollution effects, *Hydrogen ion concentration, *Plankton, *Zooplankton, *Acidic water, Acid mine water, Scenedesmus, Daphnia, Photosynthesis, Environmental effects, Aquatic populations.
Identifiers: *Lake Toya, Hokkaido, Phytoplankton, *Cyclops, Population changes, Species abundance.

Since 1939, acidic water has penetrated into Toya Lake, resulting in the decrease in pH value of the lake water, as low as pH 5.8 near the surface in recent years. The species number of plankton organisms is extremely small in recent years. An experiment was made to ascertain an influence of acidification of water on the photosynthetic activity of phytoplankton, Scenedesmus sp. cultured in the laboratory. Carbon fourteen technique was adopted to estimate photosynthesis on the experimental waters of three kinds of pH value under 1-10 klux of light intensity. In the control water (pH 7.4) photosynthesis is as high as 15 mgC/m cu/h at the optimum light intensity of 6 klux, whereas in the water of pH 5.8 which mixed acidified lake water with pond water the rate is extremely low, being 2.5 mgC/m cu/h in the optimum light intensity (4-10 klux). Experiments on the survival of two species of zooplankton, Cyclops strenuus and Daphnia pulex, in waters of various grades of pH value were made. In waters below pH 5.0 all Daphnia died within four days. In pH 6.0 water the surviving number of Daphnia was 40% of a total of individuals on the fourth day. In contrast to the above fact, all Cyclops experimented upon survived in the water of pH 5.0 for four days. Successions in the leading species of zooplankton clearly correspond to the progress of acidification of lake water. (Katz-Washington)
W71-03102

ANAEROBIC SURVIVAL OF THE CRUSTACEANS COROPHIUM VOLUTATOR, C. ARENARIUM AND TANAIS CHEVREUXI,
University Coll. of North Wales, Menai Bridge. Marine Science Lab.
J. C. Gamble.
Journal of the Marine Biological Association UK, Vol 50, p 657-671, 1970. 7 tab, 3 fig, 37 ref.

Descriptors: Anaerobic survival, Crustaceans, Amphipods, Temperature, Survival peracaridean, Water pollution effects.
Identifiers: LT50, Corophium volutator, C. arenarium, Tanais chevreuxi.

An investigation of the anaerobic survival capacities of the amphipods Corophium volutator (Pallas), C. arenarium Crawford and the peracaridean Tanais chevreuxi Dollfus shows that all are relatively resistant to anaerobic conditions. All three species survive for longer periods at lower temperatures. In Corophium small individuals are shown to be less resistant to anaerobic conditions than large. T. chevreuxi is considerably more resistant than either Corophium species, while C. volutator is slightly more so than C. arenarium. It is suggested that the high resistance of T. chevreuxi is due to its semi-sessile crevice dwelling existence and that of the Corophium species, when compared with other amphipods, is an effect of their tubiculous habits in almost anoxic substrata. (Wahtola-Washington)
W71-03103

FACTORS AFFECTING PESTICIDE-INDUCED TOXICITY IN AN ESTUARINE FISH,
Bureau of Sport Fisheries and Wildlife, Highlands, N.J. Sandy Hook Marine Lab.
Ronald Eisler.
Bureau of Sport Fisheries and Wildlife Technical Paper No 45, 1970. 20 p, 11 fig, 3 tab, 23 ref.

Descriptors: *Pesticide toxicity, *Bioassay, *Mortality, *Chlorinated hydrocarbon pesticides, *Organophosphorus pesticides, Degradation, Water temperature, Hydrogen ion concentration, Salinity, Endrin, Aldrin, Dieldrin, Heptachlor, DDT, Lethal limit, Water pollution effects, Estuarine environment.
Identifiers: Fundulus heteroclitus, Lindane, Methoxychlor, Malathion, DDVP, Methyl parathion, Phosdrin, Dioxathion, *Toxicity factors, Postexposure mortality, *Recommendations.

Factors affecting mortality caused by insecticides in the mummichog, Fundulus heteroclitus, include duration of exposure, concentration and class of chemical, degradation or alteration of experimental compounds in seawater, and temperature, alinity, and pH of the medium. Static bioassays with organochlorine (endrin, aldrin, dieldrin, heptachlor, p,p'-DDT, lindane, methoxychlor) and organophosphorus (malathion, DDVP, methyl parathion, Phosdrin, dioxathion) insecticides were conducted. Heptachlor, Phosdrin, methyl parathion, and lindane were 4.6 to 12.5 times as toxic to mummichogs at 240 hours as at 96 hours. In holding studies, mortality was high during a 240-hour observation period following 96-hour exposure. The toxicity of organophosphorus insecticides to mummichogs was directly proportional to temperature between 10 and 30C. and to salinity between 12% and 36% and inversely proportional to pH in the range 5.5 to 10. Toxicity of organochlorine insecticides to mummichogs was greatest at intermediate temperatures (20-25C.) and least at intermediate pH 97-8) within the ranges tested. Salinity of the medium had little or no measurable effect on toxicity. (Sjolseth-Washington)
W71-03104

ACUTE TOXICITIES OF ORGANOCHLORINE AND ORGANOPHOSPHORUS INSECTICIDES TO ESTUARINE FISHES,
Bureau of Sport Fisheries and Wildlife, Highlands, N.J. Sandy Hook Marine Lab.
Ronald Eisler.
Bureau of Sport Fisheries and Wildlife Technical Paper No 46, 1970. 11 p, 10 tab, 23 ref.

Descriptors: *Bioassay, *Chlorinated hydrocarbon pesticides, *Organophosphorus pesticides, Toxicity, Lethal limit, *Mortality, Endrin, DDT, Dieldrin, Aldrin, Heptachlor, Eels, Killfishes, *Pesticide toxicity, Water pollution effects.
Identifiers: Dioaxathion, Lindane, Methoxychlor, DDVP, Methyl parathion, *Estuarine fish, Fundulus heteroclitus, Atlantic silversides, Relative toxicity, Northern puffer.

Static 96-hour bioassays with 12 insecticides and seven species of estuarine teleosts (Anguilla rostrata, Fundulus heteroclitus, Fundulus majalis, Thalassoma bifasciatum, Mugil cephalus, Menidia menidia, Spaeroides maculatus) were conducted. Endrin was consistently the most toxic and methyl parathion consistently the least toxic compound tested. The descending order of insecticide toxicity to fishes at 96 hours was endrin, p,p'-DDT, dieldrin, aldrin, dioxathion, heptachlor, lindane, methoxychlor, Phosdrin, malathion, DDVP, and methyl parathion. LC50 values ranged from 0.05 to 3.1 ppb active ingredients with endrin, 0.4 to 89 ppb with p,p'-DDT, 0.9 to 34 ppb with dieldrin, 6 to 75 ppb with dioxathion, 0.8 to 194 ppb with heptachlor, 9 to 66 ppb with lindane, 12 to 150 ppb with methoxychlor, 65 to 800 ppb with Phosdrin, 27 to 3,250 ppb with malathion, 225 to 2,680 ppb with DDVP, and 5,200 to 75,800 ppb with methyl parathion. (Sjolseth-Washington)
W71-03105

FURTHER INVESTIGATIONS OF THE EFFECT OF DDT ON LEARNING IN FISH,
Fisheries Research Board of Canada, St. Andrews (New Brunswick).
D. A. Jackson, J. M. Anderson, and D. R. Gardner.
Canadian Journal of Zoology, Vol 48, No 3, p 577-580, 1970. 3 tab, 1 fig, 2 ref.

Descriptors: *DDT, *Fish behavior, Brook trout, Inhibition, Atlantic salmon, Laboratory tests, Laboratory equipment, Water pollution effects.
Identifiers: *Avoidance response, Conditional response, Learning.

Atlantic salmon parr and brook trout were treated with sublethal doses (20 to 1000 ppb) of DDT and then were subjected to training procedures for avoidance conditioning. A modified shuttlebox was used as the conditioning apparatus and the conditioning stimulus consisted of a light change. Of 16 parr and 21 brook trout treated with sublethal doses of DDT, only one (trout) failed to learn the avoidance response by 100 trials. The results indicate that sublethal doses of DDT do not per se affect learning, but that the effects produced by DDT can significantly alter the ability of the fish to perform the tasks involved. (McConnell-Washington)
W71-03106

ESTUARINE WATER QUALITY AND BIOLOGIC POPULATION INDICES,
California Univ., Berkeley.
P. N. Storrs, E. A. Pearson, H. F. Ludwig, R. Walsh, and E. J. Stann.
Fourth International Conference on Water Pollution Research, Prague, September 2-6, 1968. Preprint, 10 p, 2 tab, 4 fig, 14 ref.

Descriptors: Estuarine environment, Water quality, Surveys, On-site investigations, On-site data collections, *Water pollution effects, *Bottom sediments, Coliforms, Aquatic populations, *Benthic fauna, Oligochaetes, Regression analysis, Sulfides, Ammonia, Nitrogen.
Identifiers: *San Francisco Bay, *Aquatic ecology, *Population indices, *Species diversity.

Quantitative methods are given for measuring the relationships between water quality and aquatic ecology. Benthic animal diversity was used as a tool for assessing the adverse effects of pollution. Sediment samples were collected at 49 sampling locations throughout San Francisco Bay and analyzed for benthic animals. Changes in the species diversity index are related to levels of waste constituents in the sediments. It was shown that high sediment concentrations of sulfide and a high index of putrescibility were associated with decreased benthic animal diversity. The authors found no significant decrease in the concentrations of ammonia or nitrate nitrogen and coliform bacteria between locations having high or low benthic animal diversity. (McConnell-Washington)
W71-03107

TOXIC EFFECTS OF HYDROGEN SULFIDE TO JUVENILE FISH AND FISH EGGS,
Minnesota Univ., St. Paul. Dept. of Entomology, Fisheries and Wildlife.
Lloyd L. Smith, Jr., and Donavon M. Oseid.
25th Industrial Waste Conference, Purdue, May 6, 1970. Typescript. Paper No 7278, Scientific Journal Series, Minnesota Agr Exp Sta. 7 p, 1 fig, 6 tab, 5 ref.

Descriptors: Water pollution effects, *Hydrogen sulfide, *Fish eggs, Fish toxins, Domestic wastes, Industrial wastes, Water pollution sources, *Bioassay, *Toxicity, Incubation, Embryonic growth stage, Laboratory tests, Walleye, Rainbow trout, Pikes, Suckers, Dissolved oxygen, Lethal limit, Hatching, Viability, Evaluation.
Identifiers: Soil water interface, *Embryonic deformity, *Water quality standards, Sunfishes.

A series of bioassays were conducted with hydrogen sulfide on eggs and fry of walleye pike, rainbow trout, white suckers, and northern pike and on juvenile and adult fathead minnows, bluegills, and walleyes. Various dissolved oxygen levels were used. Fry of the four test species were much more sensitive to hydrogen sulfide than their eggs. In adult and juvenile minnows, bluegills and walleyes the range of tolerance to H2S was small. Maximum range of levels which permitted 100 percent survival and no survival was from 0.016 to 0.035 ppm in bluegills and the minimum was 0.016 to 0.021 ppm in walleyes. Eggs exposed to H2S produced the highest number of deformed embryos. Lowered dissolved oxygen levels increases the toxicity of H2S. The authors conclude that the use of 96 hour TLm values for the setting of safe standards for fish life will not be adequate. Longer exposures must be made. (Sjolseth-Washington)
W71-03108

THE EFFECTS OF DIELDRIN ON DIATOMS,
Kansas Univ., Lawrence. Dept. of Zoology.
John Cairns, Jr.
Mosquito News, Vol 28, p 172-179, 1968. 1 tab, 1 fig, 6 ref. USPHS Grant EF-00266.

Descriptors: *Dieldrin, *Diatoms, Laboratory tests, Insecticides, Water pollution effects, Algae.
Identifiers: *Effects, Navicula seminulum var.Hustedtii.

The effects of Dieldrin on Navicula seminulum was described. At a dieldrin concentration of 12.8 ppm the number of diatoms was only half that in the controls at the end of the 5-day growth period. There was no increase in the number of cells at 32.0 ppm, and a concentration of 1.8 ppm was only 10.6 percent different from the controls. (Wahtola-Washington)
W71-03183

A MODIFIED VERSION OF THE BLAZKA RESPIROMETER AND EXERCISE CHAMBER FOR LARGE FISH,
Washington Univ., Seattle. Fisheries Research Inst.
Lynwood S. Smith, and Timothy W. Newcomb.
Journal of the Fisheries Research Board of Canada, Vol 27, p 1321-1324, 1970. 2 fig, 6 ref.

Descriptors: *Respirometer, *Exercise chamber, *Equipment, Fish, Fish physiology.
Identifiers: *Blazka respirometer modification.

A modified version of the Blazka Respirometer and Exercise Chamber for large fish was described. A tube-within-a-tube respirometer has been built in which a jet outboard impeller propels the water. A towline attached to the fish through its dorsal musculature to keep it out of the pump avoids the electrolysis problems of an electric grid when using sea water. (Wahtola-Washington)
W71-03184

EFFECTS OF THE INSECTICIDE SEVIN ON VARIOUS STAGES OF THE DUNGENESS CRAB, CANCER MAGISTER,
Oregon State Univ., Corvallis. Dept. of Fisheries and Wildlife.
David V. Buchanan, Raymond E. Millemann, and Nelson E. Stewart.
Journal of Fisheries Research Board of Canada, Vol 27, p 93-104, 1970. 3 tab, 4 fig, 14 ref.

Descriptors: Water pollution effects, *Carbamate pesticides, Crabs, *Hatching, *Pesticide toxicity, Resistance, Larval, *Lethal limit, Bioassay, Growth rates, Animal behavior, Pesticide residues, Insecticide.
Identifiers: *Sevin, *Dungeness crab, *Molting, Zoeae, Life history stages, Paralysis, Sensitivity.

Of the life-history stages of the Dungeness crab the early larvae are more sensitive to Sevin than are juvenile and adults. A concentration of 1.0 mg/liter did not affect egg hatching but prevented molting of all prezoeae to zoeae. The concentration that killed 50% of the first stage zoeae during a 96-hour exposure was estimated to be 0.01 mg/liter. Few zoeae were killed in 24 hr. by 82.0 mg/liter, but the 24-hr EC50 for death within 15 days after the exposure was estimated to be 0.015 mg/liter. Survival of zoeae after 25 days exposure to concentrations of 0.0001, 0.00032, 0.001, 0.0032, and 0.01 mg/liter were 83,60,69, 21 and 0%, respectively, and control survival was 79%. The 24-hr EC50's for death or irreversible paralysis were estimated to be 0.076 and 0.35 to 0.62 mg/liter for second and ninth stage juveniles, respectively. The 24-hr and 96-hr EC50's for death or irreversible paralysis were 0.49 and 0.26 mg/liter, respectively, for adult crabs. The significance of these findings in field application of Sevin to control oyster pests and predators is discussed. (Sjolseth-Washington)
W71-03185

COMPARATIVE EFFECTS OF ABS AND LAS ON THE MOSQUITO MINNOW (GAMBUSIA AFFINIS),
Prairie View Agricultural and Mechanical Coll., Tex.
Thomas P. Dooley.
The Texas Journal of Science, Vol XX, No 2, p 147-155, 1968. 4 fig, 3 tab, 5 ref.

Descriptors: Water pollution effects, *Alkylbenzene sulfonate, *Linear alkylate sulfonates, *Bioassay, Toxicity, Fishkill, Mortality, *Lethal limit, Resistance, Animal pathology, Fish physiology, *Detergents, Fish behavior.
Identifiers: Mosquitofish, *Gambusia affinis, *Gill damage, *Histological examination.

Mosquito minnows (Gambusia affinis) exposed to 0.1% solutions of ABS and LAS were killed within 17 minutes. The survival time increased as the fish were exposed to lower concentrations. Fish reached the cut-off point in LAS at a higher concentration than ABS. This shows ABS to be more toxic than LAS. Four to 9-week old fish succombed in a shorter period of time than older ones. Females consistently withstood concentrations that were lethal to males. The gills of fish killed by ABS and LAS showed severe damage and in many cases only the skeletal portion of the gills remained. (Sjolseth-Washington)
W71-03186

TOXICITY OF PCP FOR THE 'DOJO' FISH, MISGURUNUS ANGUILLICAUDATUS (CANTOR), WITH SPECIAL REFERENCE TO THE SIZE OF FISHES (IN JAPANESE),
Ihara Agricultural Chemicals Inst., Shimizu (Japan).
For primary bibliographic entry see Field 05A.
W71-03188

TOLERANCE OF MYSIS RELICTA TO THERMAL SHOCK AND LIGHT,
National Water Quality Lab., Duluth, Minn.
Wesley E. Smith.
Transactions of American Fisheries Society, Vol 99, No 2, p 418-422, 1970. 7 fig, 9 ref.

Descriptors: Laboratory tests, Water pollution effects, Thermal pollution, *Thermal stress, *Light intensity, Mortality, *Acclimatization, Bioassay, Lethal limit, Fish food organisms.
Identifiers: Thermal tolerance, *Mysis relicta, Light tolerance, Survival.

Tests were conducted to determine the thermal tolerance and effects of laboratory illumination on survival of Mysis relicta. Mysids were affected adversely by heat stress when temperatures rose above 10C. When acclimated to a temperature of 7.5C., this species had 96-hour median tolerance limits of 16 to 16.5C. Percent mortality was essentially the same when the animals were subjected immediately to test temperatures, as when temperatures were raised gradually from acclimation temperature over a period of 5 hours. When acclimated to a temperature of 4.5C. and then subjected to temperature elevations of 1, 2.5, and 5C per day, 50% of the animals died at 16C in 16 days, 18C in 6 days and 16C in 4 days, respectively. It is suggested the Mysis relicta is an organism requiring considerable time for effective acclimation. Mysids were intolerant of exposure to normal laboratory illumination. The species lived satisfactorily in light of 10 hours a day for 2 weeks, but this period was followed by a steady mortality of about 8% of the original population per week. (Sjolseth-Washington)
W71-03189

UNITED STATES V FLORIDA POWER AND LIGHT CO (THERMAL POLLUTION OF BISCAYNE BAY).
For primary bibliographic entry see Field 06E.
W71-03260

5D. Waste Treatment Processes

THE TREATMENT OF DISPERSE TEXTILE DYE WASTES BY FOAM FRACTIONATION,
Virginia Polytechnic Inst., Blacksburg. Water Resources Research Center.
Donald L. Michelsen, and Thomas B. Fansler.
Available from NTIS as PB-196 313, $3.00 in paper copy, $0.95 in micofiche. Water Resources Research Center Bulletin No. 34, 1970. 99p, 22 tab, 17 fig, 176 ref, 2 append. OWRR Project A-017-VA (2).

Descriptors: Waste water treatment, *Foam fractionation, *Flocculation, *Textiles, Industrial wastes, Chemical oxygen demand.
Identifiers: *Dye wastes.

Laboratory foam fractionation and limited jar flocculation investigations were conducted to determine how effective foam fractionation was for the treatment of textile dispersed dye wastes and the chemical costs for such a treatment. The results indicate that cationic surfactants at about 50 ppm concentration can be used as a foaming aid to remove 52.1 percent of the COD, 89.2 percent of the color, and 75.3 percent of the turbidity from a simulated dye bath waste containing 300 ppm dye and 200 ppm dispersing agent (sodium lignosulfonate). The chemical cost would be about $210 per day to treat 1.0 MGD. Actual dilute wastes respond similarly but would be costly to treat since surfactant concentration would be 10 to 25 ppm. On the other hand, flocculation with 100 ppm alum removed 70 percent COD, 75 percent color, and 82 percent turbidity from a dilute discharge (about 1/10 of the simulated waste). Treatment cost would be $55 per MGD. (See also W71-02833)
W71-02832

TREATMENT OF DYEING BATH WASTES STREAMS BY FOAMING AND FLOTATION TECHNIQUES,
Virginia Polytechnic Inst., Blacksburg. Water Resources Research Center.
D. L. Michelsen.
Project Completion Report, December 1970. 7 p, 5 ref. OWRR Project No A-017-VA (1).

Descriptors: Waste water treatment, *Foam fractionation, *Flocculation, *Textiles, Industrial wastes, Chemical oxygen demand.
Identifiers: *Dye wastes.

Laboratory foam fractionation and limited jar flocculation investigations were conducted to determine how effective foam fractionation was for the treatment of textile dispersed dye wastes and the chemical costs for treatment. (See also W70-02832)
W71-02833

MERCER COUNTY, NEW JERSEY, COMPREHENSIVE PLAN: ANALYSIS OF WATER SUPPLY AND SEWERAGE FACILITIES OF MERCER COUNTY.
Mercer County Planning Board, Trenton, N.J.

Available from NTIS as PB-193 974, $3.00 in paper copy, $0.95 in microfiche. HUD No. NJ P-96. Final Report No 7, November 1969. 41 p, 7 tab, 2 map, 19 ref.
Identifiers: (*Regional planning, *New Jersey), (*Water resources, Regional planning), (*Sewers, Regional planning), Waste water, Waste treatment, *Mercer County (New Jersey), *Waste treatment facilities.

Approximately 266,000 of Mercer County's 300,000 population is supplied with water from public or private water sources. The remainder receives its water from individual private wells. The source of water for 75 percent of the County is the Delaware River and the Water is supplied by the city of Trenton Water Company. The analysis indicates that the County has adequate water resources to handle expected future development. Most of Mercer County's population is serviced by modern waste water collection and treatment facilities. For the remainder of the County, preliminary engineering reports and feasibility studies are studies are being prepared by municipal officials and study groups to indicate how these areas can be serviced.
W71-02834

OZONATION, NEXT STEP TO WATER PURIFICATION,
R. J. Bender.
Power, Vol 114, No 8, p 58-60, Aug 1970. 3 p, 4 fig.

Descriptors: *Ozone, *Water purification, *Water treatment, Oxidation, Costs, Sewage treatment, Sewage effluents, *Potable water, Purification, Viruses, Bacteria, *Waste water treatment, Water analysis, Concentration.
Identifiers: Bacteria control.

Ozone is a superior oxidizing agent that helps clean water more thoroughly. Ozone as a purifier is used mostly in preparing municipal potable water, and was used in Nice, France, as early as 1906. Ozonation does not replace the chlorination process. Ozone kills bacteria and viruses completely, but does not affect water taste; the slight chlorine taste introduced during preliminary treatment is eliminated. Ozonated water is completely limpid. In the U S the trend is toward ozonation of waste water and treatment of sewage effluent before release into waterways. Ozone concentrations of 0.1 ppm maintained at the exit completely disinfect sewage effluents. (USBR)
W71-02848

IRON REMOVAL USING MAGNESIUM OXIDE,
Illinois Univ., Urbana. Dept. of Civil Engineering.
John T. O'Connor, and Barrett E. Benson.
ASCE Proceedings, Journal of the Sanitary Engineering Division, Vol 96, No SA 6, Paper 7740, p 1335-1348, December 1970. 14 p, 8 ref, append.

Descriptors: *Waste water treatment, *Chemical precipitation, *Iron, *Groundwater, *Magnesium compounds, Oxygenation, Sanitary engineering, Filtration, Flocculation, Alkalinity, Aeration.
Identifiers: *Iron removal.

The calcined magnesite-diatomaceous earth process is currently being used for the removal of iron from groundwater supplies. However, information from controlled laboratory studies describing the mechanism of the reaction and the kinetics of iron removal has been lacking. The addition of finely divided MgO in dry form to waters of various pH reactions and alkalinities results in the gradual solution of MgO with approximately 3/4 dissolving in 10 minutes. Laboratory studies indicate that the rate of solution is not strongly influenced by the initial pH. Ferrous iron precipitation is incomplete within 10 minutes unless abundant oxygen is present, indicating that MgO accelerates the oxygenation of ferrous iron. Some adsorption of ferrous iron occurs on the MgO particle in the absence of oxygen. This appears to lower the rate of MgO solution. It is hypothesized that the gradual solution of MgO results in the formation of diffuse regions of high pH around the MgO particle surface where iron oxidation is greatly accelerated. (Woodard-USGS)
W71-02904

FIFTY ENVIRONMENTAL PROBLEMS OF TIMELY IMPORTANCE,
Rand Corp., Santa Monica, Calif.
For primary bibliographic entry see Field 05B.
W71-02953

ADSORPTION OF PESTICIDES BY CLAY MINERALS,
Missouri Univ., Rolla. Dept. of Civil Engineering.
J-Chang Huang, and Cheng-Sun Liao.

Journal of the Sanitary Engineering Division, Proceedings of the American Society of Civil Engineers, Vol 96, No SA 5, p 1057-1078, October 1970. 4 tab, 21 fig, 12 ref. OWRR Project A-016-Mo (3).

Descriptors: *DDT, *Dieldrin, *Hepta-chlor, *Adsorption, *Clays, Environmental engineering, Equilibrium, Mechanisms, Pesticides, Rates, Sanitary engineering, Water pollution.

The rate and equilibrium of adsorptions of DDT, dieldrin, and hepta-chlor by illite, kaolinite, and montmorillonite from aqueous pesticidal solutions are evaluated using the batch technique under laboratory conditions. The adsorption of each of these three pesticides at an initial concentration of 100 ug/l by kaolinite and illite is nearly instantaneous, with the molecules of pesticides being deposited on the clays' surfaces. As montmorillonite is an expansible clay, DDT and heptachlor are not only able to concentrate on the clay's surface but can diffuse gradually into the clay's interlamellar spaces. The adsorptive capacity of each clay is not related to its ion exchange capacities or specific surface area, yet dependent upon a specific pesticide-clay combination. The adsorption of DDT and heptachlor is relatively irreversible; however, a certain extent of dieldrin desorption occurs. It is concluded that the primary mechanisms of the adsorption of these pesticides by clays are through the formation of hydrogen bondings and some other string forces of interaction. Only in the case of dieldrin do the van der Vaals forces contribute to a significant extent to the overall adsorption reaction.
W71-02980

INDUSTRIAL BY-PRODUCT RECOVERY BY DESALINATION TECHNIQUES.
Aqua-Chem, Inc., Waukesha, Wis.
For primary bibliographic entry see Field 03A.
W71-03004

REVERSE OSMOSIS FIELD TESTING ON ACID MINE WATERS AT NORTON, WEST VIRGINIA,
Gulf General Atomic, Inc., San Diego, Calif.
S. S. Kremen, A. B. Riedinger, J. H. Sleigh, and R. L. Truby.
For saly by the Superintendent of Documents, US Government Printing Office, Washington, DC 20402. Price: $0.50. Office of Saline Water Research and Development Progress Report No 586, July 1970. 44 p, 13 tab, 5 fig, 2 ref, append. OSW Contract 14-01-0001-1836.

Descriptors: *Reverse osmosis, *Mine drainage, *Mine wastes, Osmosis, *Demineralization, *Acid mine water, West Virginia, Membranes, *Membrane processes, Waste water treatment.
Identifiers: Norton (W Va).

The objective of the program was to gain knowledge of the demineralization of acid mine drainage by reverse osmosis (RO). A 10K gpd RO unit equipped with eighteen 50 sq ft modules was employed for this work. Tests were conducted to compare high-selectivity modules with high-flux modules and 600 psi operation with 800 psi operation, and to investigate additional operation at recoveries higher than 75%. In addition, a small RO unit was used to compare GGA high-flux perchlorate membrane with commercail high-flux formamide membrane. The high-flux, 50 sq ft modules exhibited comparable rejection and a substantial increase in flux relative to the high-selectivity modules. Operation at 800 psi resulted in no loss in rejection as compared with 600 psi operation; however, the effect of the increased pressure on flux remains unclear. Operation at feedwater recoveries up to 92% was achieved. High-flux perchlorate membrane displayed flux decline and rejection comparable to those of the commercial high-flux formamide membrane. Experimentation on flux restoration through chemical treatment of the modules proved successful. A parametric study was conducted to determine the projected operation costs of 1-, 10-, and 50-million-gpd RO units. The results of this study are presented in the appendix. (Lew-Office of Saline Water)
W71-03005

DEVELOPMENT OF TUBULAR REVERSE OSMOSIS MODULE ASSEMBLY TECHNIQUES,
Aerojet-General Corp., El Monte, Calif.
For primary bibliographic entry see Field 03A.
W71-03006

REMOVAL OF LIGNIN BY FOAM SEPARATION PROCESSES,
Rutgers - The State Univ., New Brunswick, N.J. Water Resources Research Inst.
Thomas E. Wilson, and M. H. Wang.
Available from NTIS as PB-196 478, $3.00 in paper copy, $0.95 in microfiche. Water Resources Research Institute, Rutgers - the State University of New Jersey, New Brunswick, N.J., November 1970. 13 p, 4 tab, 3 fig, 14 ref. OWRR Project A-022-NJ (2).

Descriptors: *Foam fractionation, *Waste Treatment, Water pollution treatment, Water pollution, *Waste water treatment, Lignins, Ion exchange, Separation techniques, Foam separation.
Identifiers: *Ion floatation.

A laboratory investigation into foam separation processes led to largely negative results for most pollutants. However, effective removal of lignin, an important waste constituent of Kraft process paper mills, was achieved by means of the ion floatation process. Removal was from 90 to 98% effective (on a color basis) depending on conditions. (Whipple-Rutgers)
W71-03011

A COMPARISON OF EXPANDED-BED AND PACKED-BED ADSORPTION SYSTEMS,
FMC Corp., San Diego, Calif. Ordnance Engineering Div.
Charles B. Hopkins, Walter J. Weber, Jr., and Ralph Bloom, Jr.
Available from NTIS as PB-187 756, $3.00 in paper copy, $0.95 in microfiche. FWQA Robert A. Taft, Water Research Center, Advanced Waste Treatment Laboratory-II, Report No. TWRC-2, Dec 1968, p 1-74. 9 tab, 35 fig, 9 ref. FWQA Project 17020-12/68, Contract No 14-12-76.

Descriptors: *Adsorption, *Activated Carbon, Effluent, Filters, Waste water treatment.
Identifiers: *Packed Beds, *Expanded Beds, Clarification, Chemical Treatment.

The program evaluated with pilot scale adsorbers under actual filter conditions, the feasibility of the expanded-bed technique for contacting granular activated carbon with biologically treated sewage effluent, providing a comparison with the conventional packed-bed operation. The packed-bed and expanded-bed adsorption systems, operating under comparable conditions, were found essentially equivalent in their effectiveness for removal of soluble organic material from a secondary sewage effluent. Suspended solids were more effectively removed by the packed beds. Accumulation of suspended solids caused rapid increase in head loss in the packed beds, necessitating frequent cleaning of the carbon in these beds. Suspended material accumulated on individual carbon granules in the expanded beds creating larger particles of decreased density. Because the expanded beds are not subject to clogging from accumulated solids, their pumping power and maintenance requirements are lower than for a packed bed of the same size. Where the improved suspended solids removal provided by a packed bed is not required, the expanded-bed adsorber may be preferred. (Selby-Texas)
W71-03018

COST OF WASTE WATER TREATMENT PROCESSES,
Dorr-Oliver, Inc., Stamford, Conn.
David DiGregorio.
Available from NTIS as PB-187 760, $3.00 in paper copy, $0.95 in microfiche. Federal Water Pollution Control Administration, FWQA Robert A. Taft Water Research Center Report No. TWRC-6, Dec 1968. 53 p, 34 fig, 5 ref, 4 tab. Project No 17010--12168, Contract No 14-12-60.

Descriptors: *Cost, *Waste Water Treatment, Activated sludge, Trickling filters, Sludge treatment, Sludge disposal.
Identifiers: Sales, Profit, Labor, Materials.

New capital cost information for conventional and some advanced waste water treatment processes has been collected and correlated in terms of capacity and size. Operating costs have been calculated for some of the processes. Conventional processes considered include comminution, grit removal, primary settling, biological treatment of activated sludge and trickling filter, final settling, and sludge treatment and disposal. Advanced processes include phosphate extraction, chemical clarification, and sand filtration, carbon adsorption, and membrane ultrafiltration. An extensive survey of Dorr-Oliver, Inc., sales information yielded a large volume of data relating equipment costs to loading and equipment size. Costs, including profit and installation, were updated by applying factors derived from known equipment price increases. Construction costs, including material, labor, profit, engineer's and contractor's fees, were estimated from company experience and updated. The information provided is concerned only with the unit process under consideration. No effort was made to evaluate the cost of land, excavation or inter-process requirements. The method of lease squares was used to correlate the generated data. In many cases the data could be described by a straight line, Y—aX..b, on an arithmetic or logarithmic plot. Where this description was not satisfactory, an equation of the form Y—1/aX..b was used. A computer program was written to facilitate the lease square computations. (Selby-Texas)
W71-03020

ELECTROKINETIC PHENOMENA IN THE FILTRATION OF ALGAL SUSPENSIONS,
Cornell, Howland, Hayes and Merryfield, Seattle, Wash.; and Michigan Univ., Ann Arbor. Dept. of Civil Engineering.
Gerald W. Foess, and Jack A. Borchardt.
Journal American Water Works Association, Vol 61, p 333-338, 1969. 10 fig, 1 tab, 18 ref.

Descriptors: *Algae, *Sands, *Filtration, Filters, Electrophoresis, Chlorella, Scenedesmus, Adsorption, Sewage treatment, Particle size.
Identifiers: *Algal suspensions, Electrokinetic effects, Ann Arbor (Mich), Sand beds.

This investigation revealed that the attachment mechanism for discrete algae in sand filtration involves a surface affinity between the algal cells and sand grains, an interaction which can be chemically controlled. A lowering of the suspension pH value increases adsorption of the particles and thereby significantly augments the removal of suspended matter. The removal is also increased due to a reduction of the repulsive energy of sand by its coating with positively charged substances. These modifications of sand and suspended particle properties promise to increase filter removal efficiencies beyond those possible with normal doses of coagulants and with minimal head loss buildup. (Wilde-Wisconsin)
W71-03035

ON THE PROBLEM OF UNIFIED ANALYTICAL DETERMINATION OF VAPORIZABLE MONO- AND POLYPHENOLIC COMPOUNDS

IN GERMAN INVESTIGATIONS OF WATER, WASTE WATER, AND SLUDGE (IN GERMAN),
Martin-Luther-Universitaet, Halle-Wittenberg (East Germany).
Horst Thielemann.
Zeitschrift fur Chemie, Vol 9, No 10, p 390-391, 1969. 1 tab.

Descriptors: *Phenols, *Effluents, *Waste identification, Analytical techniques, Sludge, Taste.
Identifiers: Bromination analysis, Halle (Germany), Cresol, Resorcinol, Hydroquinone, Pyrogallol, Chlorophenol.

The bromination method for determination of phenolic compounds in waste waters and industrial effluents is neither well standardized nor always most advantageous. One of the shortcomings of the method is that the liberation of bromine from the potassium bromide-potassium bromate mixture is accompanied by a rise in temperature. This requires an addition of ice which influences the pH of the titrated solution and the amount of excess bromine. The results also vary depending on the period of bromination. According to the results of analyses of waste waters of Halle (Germany), 1 hour is the most desirable time for bromination. The calculation of vaporizable phenols is based on the assumption that the mean molecular weight is 102. (Wilde-Wisconsin)
W71-03047

PUBLIC SERVICE AND FACILITIES ELEMENT: SEWAGE DISPOSAL, THE CITY OF ANDERSON GENERAL PLAN.
Hahn, Wise and Associates, Inc., San Carlos, Calif.

Available from NTIS as PB-189 869, $3.00 in paper copy, $0.95 in microfiche. January 1970. 16 p.

Descriptors: California.
Identifiers: *Urban planning, *Sanitary engineering, Management planning, Reviews, Records, Sewage, Environment, Urban areas, Analysis, Mapping, Costs, *Anderson (California), Public facilities.

The report covers the following: A review of existing reports and records related to the City's sewerage system: study of environmental conditions and their influence in relation to present and prospective uses of sewerage facilities; an analysis of the existing sewerage facilities to include location of trunk sewers and lift stations; the preparation of maps, charts, diagrams, and drawings showing the essential features of the recommended improvements; and the preparation of cost estimates for the recommended improvements.
W71-03082

AEROBIC AND ANAEROBIC LANDFILL STABILIZATION PROCESS,
Stone (Ralph) and Co., Los Angeles, Calif.
Ralph Stone, and Rishab K. Gupta.
ASCE Proceedings, Journal of the Sanitary Engineering Division, Vol 96, No SA 6, Paper 7766, p 1399-1414, December 1970. 16 p, 12 fig, 1 tab, 14 ref, append.

Descriptors: *Landfills, *Aerobic conditions, *Anaerobic conditions, *Stabilization, Laboratory tests, Land reclamation, Sanitary engineering, Solid wastes, Bacteria, Biochemistry, Microorganisms, Decomposing organic matter, Aeration, Garbage dumps, Oxygen demand, Model studies.
Identifiers: *Sanitary land fills.

A series of laboratory investigations was performed to simulate the aerobic and anaerobic sanitary landfill environment. The oxygen demand of solid waste was found to be directly proportional to the amount of easily utilizable organic material present. Bread media had a higher rate of oxygen consumption than did grass or paper media. Media containing several types of solid waste showed even higher oxygen demand than that of the bread media. Under anaerobic conditions, methane production was greater in readily decomposable organic material (garbage) than in a typical cellulose waste. An aerated landfill was found to harbor many kinds of aerobic thermophilic microbes; bacteria were always predominant. Some pure culture bacteria grew at 160 deg-180 deg F. All thermophilic microbes were not cellulolytic. Purified cellulose fibers were degraded by various aerobic microbes in pure culture. (Woodard-USGS)
W71-03121

A STUDY OF WASTEWATER IRRIGATION THROUGH COMPUTER SIMULATION,
Bauer Engineering, Inc., Chicago, Ill.
Kenneth J. Cypra, Wayne Cowlishaw, and William J. Bauer.
Water Resources Bulletin Vol 6, No 6, p 935-943, November-December 1970. 9 p, 4 fig, 2 tab, 3 ref. EPA-WQO Grant 11010 FMY.

Descriptors: *Simulation analysis, *Water reuse, *Waste water disposal, *Irrigation water, Sewage effluents, Michigan, Mathematical models, Systems analysis, Computer programs, Water storage, Waste treatment, Lagoons.
Identifiers: *Wastewater irrigation, *Muskegon (Mich).

Muskegon, Michigan, typical of a medium-sized Northern urban area, is currently adopting wastewater irrigation to meet its present and future wastewater treatment needs. Design of a system for Muskegon, Michigan must consider, among other things, the quantity of storage needed prior to irrigation and the quality of water in the storage lagoons. A computer-simulated operation of the storage and irrigation aspects of the proposed wastewater irrigation system resulted in a better understanding of storage requirements and critical quality parameters (particularly anaerobic conditions during spring break-up). Results are depicted in terms of maximum storage requirements and in terms of average monthly outflow. Maximum storage requirements occur in April and May before the start-up of spring irrigation. Maximum wastewater irrigation occurs April to July with the peak varying according to the irrigation rate. Quality values are generally independent of the rates of irrigation. The BOD level within the storage lagoons is estimated to range from about 12 to 43 mg/liter, with DO levels ranging from 0 to about 8 mg/liter. The simulation program is written in FORTRAN IV for acceptance by the GE Mark I series computer. (Knapp-USGS)
W71-03126

ECONOMICS OF CANNERY WASTE TREATMENT,
Water Resources Engineers, Inc., Walnut Creek, Calif.
D. E. Evenson, and G. T. Orlob.
Water and Sewage Works, Vol 117, No 3, p IW/17-IW/21, March 1970. 2 fig, 2 tab.

Descriptors: *Canneries, *Dynamic programming, *Waste water treatment, *Decision making, Waste treatment, Aerobic treatment, Biological treatment, Industrial wastes, Water pollution control, Water pollution abatement, Water pollution sources, Project planning, Planning, Abatement, Economics, Optimization, Cost analysis.
Identifiers: *Cannery wastes.

In this study the method of dynamic programming was used to investigate the economics of cannery waste treatment. Liquid waste streams were characterized by their BOD, and solids generated in treatment were characterized by their volume. For the problem studied, it was found that a system consisting of screening an aerated lagoon, and depending on plant size, either composting or land fill disposal of solids was most economical. Minimum cost-size-efficiency relationships were used to evaluate the alternatives between treating the wastes in-plant, discharging to a municipal system or combinations of the two. The study neglects possible economies through changes in the canning processes; only waste treatment alternatives are considered. Techniques to analyze the entire waste problem require further development. More research is necessary to obtain information relating treatment efficiency to plant size and cost, and to determine the relationship between liquid waste treatment and solids generation. (Hewett-Rutgers)
W71-03219

5E. Ultimate Disposal of Wastes

HYDROGEOLOGY OF SOLID WASTE DISPOSAL SITES IN MADISON, WISCONSIN,
Wisconsin Univ., Madison. Water Resources Center.
For primary bibliographic entry see Field 05B.
W71-02825

DISPERSAL OF PLATING WASTES AND SEWAGE CONTAMINANTS IN GROUND-WATER AND SURFACE WATER, SOUTH FARMINGDALE - MASSAPEQUA AREA, NASSAU COUNTY, NEW YORK,
Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 05B.
W71-02922

BRINE DISPOSAL POND MANUAL,
Bureau of Reclamation, Denver, Colo. Engineering Research Center.
Maurice E. Day.
For Sale by Supt. of Documents U.S. Government Printing Office Washington, D.C. 20402. Price $1.25. Office of Saline Water Research and Development Progress Report No 588, August 1970. 134 p, 6 tab, 17 fig, 5 append. OSW Contract 14-01-0001-1306, Work Order No 3.

Descriptors: *Brine Disposal, *Desalination, *Ponds, Costs, Disposal, Waste water disposal, Waste disposal, *Linings.
Identifiers: Design criteria, *Solar ponds, *Disposal ponds, Inland desalting plants.

This manual covers the design and construction of brine disposal ponds for use in disposing of waste brine from inland desalting plants. Specific design criteria are presented for a hypothetical brine disposal pond system based on data from the vicinity of Roswell, New Mexico. Estimates of the cost of various sizes of multiple pond systems are made based on the design criteria assumed for the Roswell site. Operation and maintenance requirements which affect the planning of a brine disposal system are included. The manual presents data on various linings considered suitable for ponds and gives construction information for lining installation. A summary of the regulations of various states with respect to ponding is included as an appendix. (Gransee-Office of Saline Water)
W71-02950

PUBLIC SERVICE AND FACILITIES ELEMENT: SEWAGE DISPOSAL, THE CITY OF ANDERSON GENERAL PLAN.
Hahn, Wise and Associates, Inc., San Carlos, Calif.
For primary bibliographic entry see Field 05D.
W71-03082

MARINE DISPOSAL OF SOLID WASTES,
Public Health Service, Cincinnati, Ohio.
Charles G. Gunnerson, Robert P. Brown, and David D. Smith.
ASCE Proceedings, Journal of the Sanitary Engineering Division, Vol 96, No SA 6, Paper 7769, p 1387-1397, December 1970. 11 p, 5 fig, 2 tab, 16 ref.

Descriptors: *Solid wastes, *Disposal, *Oceans, Water pollution sources, Sanitary engineering, Ecology, Legal aspects, Planning, Regulation, Data collections.

Identifiers: *Refuse disposal, Offshore disposal sites.

In 1968, approximately 48,000,000 tons of wastes from the civilian sector were disposed in the United States coastal waters at an estimated cost of $29,000,000 by tug and barge operations. All indications point to increasing amounts in the future. There are critical needs for baseline environmental data, adequate monitoring systems, and establishment of responsibility for regulating discharges of solid or containerized wastes at sea. Many agencies have responsibilities that bear on the marine disposal of solid wastes. The most troublesome factor is the lack of jurisdiction on the seas beyond the 3-mile limit or on the bottom beyond the Continental Shelf. (Woodard-USGS)
W71-03120

SYSTEMS ANALYSIS OF BRINE DISPOSAL FROM REVERSE OSMOSIS PLANTS,
Dow Chemical Co., Midland, Mich.
P. G. LeGros, C. E. Gustafson, B. P. Shepherd, and W. F. McIlhenny.
For sale by Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402. Price: $1.75. Research and Development Progress Report No 587, August 1970. 202 p, 57 tab, 69 fig, 49 ref. OSW Contract 14-01-0001-2252.

Descriptors: *Brine disposal, Ponds, *Desalination, Deep wells, Pretreatment, Intakes, *Costs, *Systems analysis, Osmosis.
Identifiers: Geologic considerations, *Reverse osmosis, Design criteria, Solar ponds, Cost estimates, Meteorological considerations, Inland desalting.

Reverse osmosis desalting systems were analyzed for six inland locations to determine the effects of disposal methods on total system cost. Communities were selected which would represent a range of feedwater types, evaporation rates and underground geology. The six communities were Minot, N. D.; Arkansas City, Kansas; Clinton, Oklahoma; Midland, Texas; Gallup, New Mexico; and Fort Morgan, Colorado. The desalting system was divided into its functional components: feedwater acquisition, pretreatment, reverse osmosis, waste preconditioning and waste disposal. Engineering designs were prepared and costs estimated for the intake, source well, disposal well and evaporation pond elements at several levels of flow rate. Unit costs were derived for the various elements for plant recovery rates from 0.5 to 0.98. For the six case communities the most economical operating recovery factors ranged between 0.9 and 0.98. Product water unit costs of the several functional components were combined to give the total system cost. Lowest total system unit costs for the 1 MGD capacity system ranged from $0.84 to $1.19 per 1000 gallons of fresh water. (Gransee-Office of Saline Water)
W71-03216

5F. Water Treatment and Quality Alteration

MERCER COUNTY, NEW JERSEY, COMPREHENSIVE PLAN: ANALYSIS OF WATER SUPPLY AND SEWERAGE FACILITIES OF MERCER COUNTY.
Mercer County Planning Board, Trenton, N.J.
For primary bibliographic entry see Field 05D.
W71-02834

OZONATION, NEXT STEP TO WATER PURIFICATION,
For primary bibliographic entry see Field 05D.
W71-02848

REMOVAL OF COLOR FROM THE WATER OF WAIKOLOA STREAM, SOUTH KOHALA DISTRICT, ISLAND OF HAWAII,
Hawaii Univ., Honolulu. Water Resources Research Center.
Nathan C. Burbank, Jr., Po Lau Chan, and Reginald H. F. Young.
Available from NTIS as PB-196 359, $3.00 in paper copy, $0.95 in microfiche. Hawaii University Water Resources Research Center Technical Report No 38, March 1970. 21 p, 10 fig, 1 tab, 5 ref. OWRR Project A-999-HI (5).

Descriptors: *Color reactions, *Analytical techniques, *Water treatment, *Water quality, *Hawaii, Streams, Colorimetry, Color, Water analysis, Coagulation, Colloids, Zeta potential, Catalysts, Cation adsorption.
Identifiers: *Water color removal, Alum sulfate, Ferric sulfate, Cationic polyelectrolyte.

The colored bodies in the water of the Waikoloa Stream (Hawaii) are predominantly organic in origin with the color colloid having a negative charge. The color of the water varies from a maximum value of 320 units to a minimum value of 22 units. The average value is about 80 units. The zeta potential of the color colloid has varied from negative 36 mv to negative 18.5 mv. It was possible to remove color to the U. S. Public Health Service standards for interstate carriers by coagulating the color bodies with either alum or ferric sulfate. Cationic polyelectrolyte aids reduced the quantity of the coagulant required to effect color removal; decreased the required retention time in the flocculation basin; and caused a faster rate of sedimentation. The most satisfactory coagulant aid is a cationic polymer, which not only acts as an aid but also as a true coagulant in color removal. Reductions by as much as 20% in the amount of primary coagulant required is possible while obtaining the same results. The optimum pH range is 6 to 7 and the optimum dosage of cationic polymer is from 1 to 3 mg/l in conjunction with 15 to 20 mg/l coagulant. (Woodard-USGS)
W71-02884

THE EFFECTS OF COPPER SULFATE ON CERTAIN ALGAE AND ZOOPLANKTERS IN WINNISQUAM LAKE, NEW HAMPSHIRE,
New Hampshire Univ., Durham. Water Resources Research Center.
Philip J. Sawyer.
Available from NTIS as PB-196 481, $3.00 in paper copy, $0.95 in microfiche. New Hampshire Water Resources Research Center, WRR-2, 1970. 28 p, 2 fig, 5 tab, 17 ref. OWRR Project A-004-NH (4).

Descriptors: *Copper sulfate, *Algae, *Zooplankters, *Chemcontrol, New Hampshire, Copepods, Daphnia, Sampling, Depth, Cyanophyta, Chrysophyta, Chlorophyta, Primary productivity, Carbon radioisotopes, Photosynthesis.
Identifiers: *Winnisquam Lake (N H), Anabaena circinalis, Bosmina longirostris, Synura uvella, Dinobryon, Oscillatoria limnetica, Dictyosphaerium, Cell counts, Fragilaria, Asterionella, Cryptomonas, Sphaerocystis, Daphnia galeata mendotae, Daphnia magna.

In a relatively unbuffered lake such as Winnisquam, control of cyanophycean bloom can be accomplished with relatively small amounts of copper sulfate --4 lbs/acre. Data on 27 algal species present before, during, and after addition of copper sulfate indicate that a rapid shift in species relationships occurred. Carbon fixation rate was found to be a more sensitive measure of bloom potential than cell counts. Susceptible species decreased in numbers; other forms increased in population; some appeared unaffected by treatment. The latter group may have been protected by natural resistance or by their position in the water column. Zooplankton reacted to copper treatment in various ways. The effects on microcrustaceans such as copepods and daphnids seemed to follow a predictable pattern. Copepods and Bosmina longirostris were more resistant than Daphnia. Bosmina multiplied to a concentration of 154/liter in the top meter of the water column. The rise and fall of specie numbers of plants and animals and their rapid response to conditions after copper sulfate treatment illustrate their complex relationships. The crude treatment with copper sulfate did produce control of an obnoxious blue-green alga, Anabaena circinalis. (Jones-Wisconsin)
W71-03014

UTILIZATION OF ALKOXYSILANES FOR REDUCTION OF THE ABUNDANCE OF PHYTOPLANKTON DURING 'BLOOMS' OF WATER BASINS (IN RUSSIAN),
Moscow State Univ. (USSR).
N. S. Stroganov, V. G. Khobotiev, L. V. Kolosova, and M. A. Kadina.
Doklady Akademii nauk SSSR, Vol 181, No 5, p 1257-1259, 1968. 2 fig, 2 tab, 13 ref.

Descriptors: *Herbicides, *Algae, Toxicity, Scenedesmus, Chlorella, Daphnia, Deterioration, Water treatment, Degradation (Decomposition).
Identifiers: *Algal blooms, *Organo-silicates, *Alkoxysilanes, Scenedesmus quadricauda, Chlorella vulgaris, Daphnia magna, Limnaea stagnalis, Ouspenskii's medium.

A search for herbicides suppressing algal blooms, but harmless to zooplankters and other hydrobionts lead to investigation of organo-silicates: venyltriethoxysilane, tetraethoxysilane, and trifluoropropenyl- (methyl)-diethoxysilane. The test organisims included Scenedesmus quadricaude, Chlorella vulgaris, Daphnia magna, and Limnaea stagnalis. The count of survived specimens showed that the concentration of 0.01 mg/liter of all investigated compounds eliminated 93% to 96% of algal cells without damaging either daphnia or mollusks. Among the advantages of the alkoxysilanes is their relatively rapid disintegration in water. (Wilde-Wisconsin)
W71-03056

ACTIVATED GRANULAR CARBON FILTRATION - SOME ASPECTS TO CONSIDER,
Westvaco Corp., Covington, Va. Chemical Div.
A. Y. Hyndshaw.
Journal of the New England Water Works Association, Vol 84, No 2, p 105-126, June 1970. 10 fig.

Descriptors: *Activated carbon, *Adsorption, *Water purification, *Water treatment, Carbon, Filters, Design, Sanitary engineering.
Identifiers: *Granular activated carbon, *Powdered activated carbon, Dechlorination.

This paper begins with a brief discussion of the history and mechanism of activated granular carbon filtration in water treatment. Procedures are given for the estimation of carbon dosage and column configurations based on experimental studies. The relative economy of powdered and granulated carbon systems is discussed in relation to factors such as relative carbon dosage, chlorine replacement, carbon attrition loss in granular systems, possible savings in back wash water with certain granular carbon systems, possible regeneration of granular carbon, and the higher dechlorination capacity of granular carbon. Areas in which present knowledge is limited and further study is necessary are mentioned. It is concluded that in treatment plants requiring low dosages of powdered carbon, powdered carbon is more economical than granular carbon, but that granular carbon may be advantageous where high powdered carbon dosages are used, or where superchlorination is practiced. Furthermore, it is concluded that pilot plant studies are impractical where powdered carbon dosages less than 2 ppm are required, because of the extremely long test periods necessary. (Hewett-Rutgers)
W71-03223

5G. Water Quality Control

FLOW CONCENTRATION GROINS FOR REAERATION IN PASSAIC RIVER - A HYDRAULIC MODEL STUDY,
Rutgers - The State Univ., New Brunswick, N.J. Water Resources Research Inst.
E. L. Bourodimes, and L. Michna.
Available from NTIS as PB-196 476, $3.00 in paper copy, $0.95 in microfiche. Water Resources Scientific Information Center, Department of the Interior, Washington, DC 20240. Water Resources Research Institute, Rutgers University, New Brunswick, New Jersey, September 1970. 99 p, 16 tab, 22 fig, 27 ref, A-023-NJ (1).

Descriptors: *Hydraulic design, *Hydraulic engineering, *Water quality control, Hydraulics, Turbulence, New Jersey, Hydraulic models, *Reaeration aeration, Flow rates.
Identifiers: *Instream aeration, Surface aerators, *Passaic River (NJ), Flow concentration, Flow velocity.

For the purpose of reaeration of polluted rivers, a mechanical surface aeration device was tested by the Water Resources Research Institute of Rutgers University. At low flows the aerator has a tendency to recirculate the same once-aerated water within the basin. The flow concentration devices are proposed to be used with the mechanical aerator to increase the streamflow velocity and the level of stream turbulence along the approach to the aerator. This should diminish recirculation of the water due to higher velocities, and enhance the level of turbulence. This investigation reports on the hydraulic model of the proposed flow concentration devices performance in relation to the mean flow velocity and turbulence characteristics and measurements. Some of the important conclusions are: (1) The determination of hydrodynamic aspects of flow discharge, velocity distribution and turbulence characteristics of the model tested are in fair agreement with existing results. (2) It was clearly demonstrated that the technique of stream flow concentration devices provides marked increase of mean velocities along the center line of the channel. (Whipple-Rutgers)
W71-03009

LAKE EUTROPHICATION--WATER POLLUTION CAUSES, EFFECTS AND CONTROL.
Minnesota Univ., Minneapolis. Water Resources Research Center.

Available from NTIS as PB-196 479, $3.00 in paper copy, $0.95 in microfiche. 'Save the Lakes Symposium' held at Detroit Lakes, Minnesota, August 18-19, 1969. Water Resources Research Center, University of Minnesota, Minneapolis, Bulletin No 22, 1970. 61 p. OWRR Project A-999-MINN (13).

Descriptors: *Eutrophication, *Lakes, *Water pollution, Minnesota, Water quality, Nutrients, Sediments, Coliforms, Municipal wastes, Agriculture, Fallout, Drainage, Management, Wisconsin, Productivity, Algae, Economics, Political aspects, Geology, Topography, Groundwater, Biochemical oxygen demand, Phosphorus, Fish, Weeds, Cycles, Bacteria, Chemistry, Physics, Stratification, Biological treatment, Viruses, Cyanophyta, Legislation, Chemcontrol.
Identifiers: Detroit Lakes (Minn), Community action, Lake Sallie (Minn), Lake Melissa (Minn), Nutrient removal.

Papers presented at 'Save the Lakes Symposium' held at Detroit Lakes, Minnesota, August 18-19, 1969, focused on lake pollution and eutrophication: what it is, what causes it, the technology needed and available to control it, and the type of community action that can and must be taken for effective control and improvement. The purpose is to make facts available to the public and to clarify the cooperative role of citizens and government. The life cycle of a lake is described. Improved methods of lake management may be uncovered in fundamental studies dealing with present sources of pollution, municipal sewage and diffuse sources, such as agricultural operations, fallout and washout from air, drainage, and the technical problems involved. The history and diversion of wastes at Madison, Wisconsin, Lake Tahoe and Lake Washington is described. Besides the scientific areas, the major problems are lack of political leadership necessary for proper evaluation of water quality and providing financing necessary for solution. The geological history of the Detroit Lakes is given. There are many means of alleviating eutrophication: ecological control, biological control, chemical control, and mechanical control. (Jones-Wisconsin)
W71-03012

STUDIES ON THE INTERACTIONS OF AQUATIC BACTERIA AND AQUATIC NEMATODES,
Auburn Univ., Ala. Water Resources Research Inst.
Gerald R. Wilt, and Roger E. Smith.
Available from NTIS as PB-196 480, $3.00 in paper copy, $0.95 in microfiche. Alabama Water Resources Research Institute Bulletin 701, 1970. 67 p, 58 fig, 12 tab, 25 ref. OWRR Project A-006-ALA (1).

Descriptors: *Aquatic bacteria, *Nematodes, Pseudomonas, Mud, Bottom sediments, Nutrients, Ammonia, Toxicity, Temperature, Yeasts, Molds, Organic matter, Worms, Thermal pollution, Sampling, Reservoirs, Farm ponds, Fish hatcheries, Rivers, Streams, Fungi, Alabama, Salmonella, Enzymes, Aquatic populations, Food chains.
Identifiers: *Inland waters, *Bacteria-nematode association.

Interactions of aquatic bacteria and aquatic nematodes were investigated to determine number and kinds of bacteria found in aquatic nematodes throughout Alabama, the effect of various bacterial metabolites on certain aquatic nematodes, and effect of various nematode products on growth of bacteria isolated from them. A total of 1842 potential bacterial-feeding nematodes from bottom mud samples were surfaced, cleansed, crushed, and the residue cultured for associative bacteria of 15 genera. In determining suitability of bacteria as sole nutrient, nematodes showed growth and reproduction in a wide range of bacterial cell concentrations. 23 of 25 bacterial isolates tested, provided all substances necessary for development of a nematode population in monoxenic cultures. Assay nematodes responded differently when fed the same species of bacteria suggesting differences in bacteria suitability as nematode nutrient. In vitro studies showed nematodes could locate a food base placed at a distance. Certain bacteria produce nematocidal metabolites which could serve as biological control agents of certain nematodes. Chromobacterium produced two volatile toxic substances--cyanide and ammonia. Increased temperature, where bacterial cells and nematodes are growing, may cause otherwise nutritious bacteria to become toxic. (Jones-Wisconsin)
W71-03013

PROCESS CONTROL MODEL FOR OXYGEN REGENERATION OF POLLUTED STREAMS,
Rutgers - The State Univ., New Brunswick, N. J. Water Resources Research Inst.
Burton Davidson, and J. V. Hunter.
Available from NTIS as PB-196 482, $3.00 in paper copy, $0.95 in microfiche. Research Project Technical Completion Report, Water Resources Research Institute, Rutgers University, New Brunswick, New Jersey, Mar 1970. OWRR, Project B-011-NJ (1).

Descriptors: *Optimization, Water pollution, Water quality, Dissolved oxygen, Biochemical oxygen demand, Chemical oxygen demand.
Identifiers: Optimal Control Theory, Lumped and distributed parameter systems, Organic carbon.

The objectives of the project were divided into experimental and theoretical parts. In the experimental part (part I), the objective was to correlate rapidly determined parameters (i. e. chemical oxygen demand, organic carbon and ammonia) with 5-day BOD using linear regression analysis on samples taken from the Passaic River in New Jersey. Equations were developed for the prediction of the 5-day BOD -20C- (dilution technique), the 5-day 20C BOD (Warburg technique), and the 20-day 20C BOD (Warburg technique) from the ammonia, organic carbon, and chemical oxygen demand concentrations. The resulting equations indicated that only somewhere between 40% and 80% of BOD variations were reflected by the concentrations of the parameters. Although the reason for this is not too clear, it does indicate that the predictions of biological oxygen consumption from a knowledge of the concentrations of chemical oxygen are dubious and their use in a control system rather hazardous. In the theoretical part (part II), the objective was to provide control models for simulating staged instream aerators based on experimental data taken from the Passaic River instream aeration project. The models were computerized on an analog computer for use in obtaining oxygen-uptake rates and parameter values. As part of the theoretical investigations (part III), the optimal instream aeration problem was formulated and analyzed in terms of Pontryagin's Minimum Principle. (Davidson-Rutgers)
W71-03015

BIOGEOCHEMICAL MODELING OF EUTROPHIC LAKES FOR WATER QUALITY IMPROVEMENT,
Notre Dame Univ., Ind. Dept. of Civil Engineering.
M. W. Tenney, W. F. Echelberger, Jr., P. C. Singer, F. H. Verhoff, and W. A. Garvey.
Fifth International Conference on Water Pollution Research, San Francisco, California, July 26-August 1, 1970. Preprint. 22 p, 4 fig, 2 tab, 17 ref.

Descriptors: *Systems analysis, *Water quality, *Eutrophication, *Mathematical models, Simulation, Analytical techniques, Phosphorus, Algae, Lakes, Microorganisms, Tertiary treatment, Effluents, Model studies.
Identifiers: Heterotrophs, Autotrophs.

A mathematical simulation of biogeochemical exchanges in a lake system and its use in synthesising the eutrophication history are described. Taken as a single-stage, continuous-flowing reactor system with variable inputs and outputs, general trends are predictable. The concentration of organic carbon and phosphorus determine the extent of heterotrophic and autotrophic activity in the model, and the resultant activity is measured as suspended solids. Internal exchanges between state and location of pollutants is characterized by rate functions, and when necessary, a stochiometry of each of the bio- and physical reactions is included. A deterministic simulation model was applied to Stone Lake, Cassopolis, Michigan, and reasonable predictions were made with regard to organic material, inorganic phosphorus, and suspended microorganisms. The model is applicable to prediction of future water quality and certain manipulation procedures to enhance water quality. Ecological modeling developments will assist political decisions leading to development of successful concepts in water quality management. (Auen-Wisconsin)
W71-03021

A TWO-YEAR STUDY OF BACTERIAL POPULATIONS IN INDIANA FARM POND WATERS,
Purdue Univ., Lafayette, Ind. Agricultural Experiment Station.
L. B. Hughes, and H. W. Reuszer.
Indiana Academy of Science, Vol 79, p 423-431, 1970. 3 fig, 4 tab, 7 ref. OWRR Project A-005-IND (15).

Descriptors: *Bacteria, *Indiana, *Farm ponds, Sampling, Surfaces, Depth, Seasonal, Temperature, Organic matter, Turbidity, Hydrogen ion concentration, Nitrates.

The changes were determined in numbers of bacteria in farm pond waters and some factors possibly influencing bacterial numbers were investigated. A 2-year study of bacterial populations in farm pond waters was conducted on three farm ponds at the Southern Indiana Purdue Agricultural Center. Samples of water from the surface and near the bottom were taken approximately once each month; bacterial numbers were determined by colony counts. Great differences in bacterial numbers were found between ponds, and large seasonal variations in bacterial numbers were found within ponds. Maximum numbers occurred in late spring or early summer in all three ponds. Consistently higher numbers of bacteria were present in Pond C and lowest numbers in Pond B. Water temperatures were quite similar in all three ponds, although a significant correlation between water temperature and bacterial numbers was found only in Pond C. Organic carbon content was consistently highest in Pond C and lowest in Pond B. Significant positive correlation coefficients between organic carbon and bacterial numbers were found in Ponds A and B, but a significant negative correlation was found in Pond C. (Jones-Wisconsin)
W71-03023

AUTOECOLOGICAL AND SAPROBIOLOGICAL INVESTIGATIONS OF FRESH WATER CILIATES (IN GERMAN),
Bonn Univ. (Germany). Zoological Inst.
Hartmut Bick.
English summary. Hydrobiologia, Vol 31, No 1, p 17-36, 1968. 13 ref.

Descriptors: *Indicators, *Protozoa, *Environment, *Organic matter, Water quality, Temperature, Hydrogen ion concentration, Oxygen, Carbon dioxide, Ammonia, Nitrites, Hydrogen sulfide, Salinity, Lakes, Nutrients, Bacteria, Algae, Brackish water, Alkaline water, Sodium.
Identifiers: *Ciliates, Flagellates, Saprobien system, Ciliate autoecology.

Ecological valencies of 31 sp of fresh water ciliates are presented in tabulated form. Environmental factors include temperture, pH, oxygen, carbon dioxide, free and bound ammonia, nitrites, hydrogen sulfide, and the total concentration of salts in brackish waters and inland alkaline lakes enriched in sodium. This record is supplemented by a number of bacteria, accompanying different ciliates. As far as possible, the optimum ranges of site factors are given for different species. The autoecological results are related to the indicator value of species for the Saprobien System of monitoring water quality. (Wilde-Wisconsin)
W71-03031

EVALUATING INSTREAM AERATION OF POLLUTED RIVERS,
Rutgers - The State Univ., New Brunswick, N.J. Dept. of Environmental Sciences; and Rutgers Univ., New Brunswick, N.J. Water Resources Research Inst.
Joseph V. Hunter, and William Whipple, Jr.
Journal Water Pollution Control Federation, Vol 42, No 8, Part 2, p R249-R262, 1970. 8 fig, 2 tab, 10 ref. FWQA Project No 16080 DUP, OWRR Project B-010 NJ, B-011 NJ, and B-022 NJ.

Descriptors: *Water quality control, *Streams, *Aeration, *Dissolved oxygen, Waste treatment, Oxygenation, Decomposing organic matter, Systems analysis, Biochemical oxygen demand, Stochastic proscesses, Mathematical models, Simulation analysis, Flow measurements, Model studies.
Identifiers: Aerators, Oxygen transfer rates, Mass balance analysis, Passaic River (NJ), Benthal respirometer.

Observations of full scale aerators on a small polluted river confirmed the economy of instream aeration for rivers in which secondary treatments of wastes do not achieve desired dissolved oxygen levels. Electrically driven aerator provided 50% greater efficiency of oxygen transfer at the highest discharge of about 1.0 cfs. The photosynthetic reoxygenation, benthal decomposition, and deoxygenation were investigated by using dark-light bottles, benthal respirometer, and determination of oxidized forms of nitrogen. The parameters obtained were applied to mathematical modeling and the process of dynamic simulation was used with a TR-48 analog computer. The difficulties of excessive aeration were avoided by analysis of biochemical oxygen demand mass balance. (Wilde-Wisconsin)
W71-03038

REAERATION MEASUREMENTS IN A EUTROPHIC STREAM,
Pennsylvania State Univ., University Park. Dept. of Civil Engineering.
Wilber A. Blain, and Archie J. McDonnell.
Reprinted from the Proceedings of the 22nd Industrial Waste Conference, Purdue University, May 1967. Pennsylvania State University, Institute for Research on Land and Water Resources, University Park, Reprint Series No 1, p 1044-1058, 1967. 7 fig, 5 tab, 13 ref, 2 append. A-003-PA (2).

Descriptors: *Mathematical studies, *Dissolved oxygen, *Reaeration, Correlation analysis, Equations, Temperature, Biochemical oxygen demand, Streams, Respiration, Benthos, Analysis.
Identifiers: *Reaeration coefficient, O'Connor-Dobbins equation, Isotropic turbulence formula, Spring Creek (Pa).

Reaeration rate studies were conducted in a small eutrophic stream. Dissolved oxygen and temperature were continuously recorded to obtain estimates of the reaeration coefficient. The determined coefficients were compared with values from prediction formulae. The analyses of night dissolved oxygen-time data provided a method for establishing reaeration coefficient in streams in which accurate estimates of spatial oxygen consumption is difficult. Most accurate predicted value of the coefficient were obtained with O'Conner-Dobbins equation. (Wilde-Wisconsin)
W71-03046

QUANTITATIVE ESTIMATION OF MIGRATORY FISH SURVIVAL UNDER ALTERNATIVE WATER QUALITY CONTROL PROGRAMS,
Federal Water Quality Administration, Edison, N.J.
For primary bibliographic entry see Field 05C.
W71-03058

SYSTEM ECONOMIC RESPONSE TO WATER QUANTITY AND QUALITY - FUNDAMENTAL CONSIDERATIONS,
Utah Water Research Lab., Logan.
For primary bibliographic entry see Field 06B.
W71-03067

MATHEMATICAL MODELING OF GULF COAST ESTUARIES,
Texas A and M Univ., College Station. Dept. of Civil Engineering.
Roy W. Hann, Jr.
Water Resources Bulletin, Vol 6, No 3, p 323-338, May-June 1970. 16 p, 9 fig, 2 tab. FWPCA R and D Grant 16090DQW.

Descriptors: *Computer models, *Analytical techniques, *Estuaries, *Mathematical models, *Water quality control, *Systems analysis, Pollution, Streamflow, Dissolved oxygen, Texas.
Identifiers: Gulf Coast, Steady-state models, San Bernard River.

An outline is presented of the dominant characteristics which affect the properties of the Gulf Coast estuaries including geography, tide and current effects, wind effects, salinity and density regime, nature and level of waste discharges, low inflow levels, dredging effects and present quality levels. Two basic levels of analytical modeling which are useful in water quality management were presented. The first was a relatively crude completely mixed estuarine model which permitted economical evaluation of varying parameters. The streamflow analysis was made on the San Bernard Estuary and a total of over 2000 separate analyses were made under a variety of system conditions to provide sufficient answers for trends to be analyzed and displayed. The second model was a very general steady state model which permitted analysis of stratified systems. It was a segmentized finite difference model and calculated steady-state distribution of organic wastes and other materials with a defined decay function and resulted in a dissolved oxygen profile for combinations of waste loads to the sytem. The ESTPOL computer language designed to simplify the use of the steady state model was described. The practical use of the analytical models as management tools for the solution of Texas Estuarine quality problems was demonstrated. (Kriss-Cornell)
W71-03074

DEVELOPMENT OF A GROSS TOXICITY CRITERION IN SAN FRANCISCO BAY,
Engineering-Science, Inc., Arcadia, Calif.; and California Univ., Berkeley.
For primary bibliographic entry see Field 05C.
W71-03097

MARINE DISPOSAL OF SOLID WASTES,
Public Health Service, Cincinnati, Ohio.
For primary bibliographic entry see Field 05E.
W71-03120

EVALUATING INSTREAM AERATION OF POLLUTED RIVERS,
Rutgers - The State Univ., New Brunswick, N.J. Water Resources Research Inst.
J. V. Hunter, and W. Whipple.
Journal Water Pollution Control Federation, Part 2, Vol 42, No 8, p R249-R262, August 1970. Federal Water Quality Administration Program 16080 DUP.

Descriptors: *Aeration, *Oxygenation, *Water pollution control, *Dissolved oxygen, *Systems analysis, Biochemical oxygen demand, Optimization, River flow, Stochastic processes.
Identifiers: *BOD mass balance, *Instream aeration.

The paper gives results of operation of full-scale aerators on a small polluted river under carefully controlled conditions, and of the analytical methods found applicable. The results confirm the economy of instream aerators for non-tidal rivers, where secondary treatment of wastes is not sufficient to achieve desired D.O. levels. The oxygen uptake rates of the aerators were reduced to standard conditions, for comparability with other methods. The systems analysis of the basin was conducted by means of a BOD mass balance analysis, having consideration for observed benthal and photosynthetic effects. Considerations of water quality variability indicate that a stochastic basis for water quality standards should be utilized. (Whipple-Rutgers)
W71-03224

IN-STREAM AERATION: AN ALTERNATIVE TO ADVANCED WASTE TREATMENT,
Rutgers - The State Univ., New Brunswick, N.J. Water Resources Research Inst.
William Whipple, Jr.
Civil Engineering - ASCE, September 1970, p 78-80.

Descriptors: *Aeration oxygenation, *Water pollution control, *Dissolved oxygen, *Systems analysis, *Biochemical oxygen demand, *Water quality control, Optimization, River flow, Stochastic analysis.

Identifiers: *BOD mass balance, *Instream aeration, Recorded effluents, Unrecorded BOD loading, Background BOD loading.

Planning of water quality control must include a systems analysis of the entire basin. This must include all sources of pollution, not just the recorded effluents. In New Jersey, study of pollution sources of three watersheds indicated large unrecorded BOD loadings. Accordingly, it may be more difficult than anticipated to meet water quality standards by treatment alone. To meet this situation a systems analysis of the Passaic River has been conducted by the method of BOD mass balance analysis, and tests and studies have been made of instream aeration, using prototype equipment of two different types. Comparative estimates indicate that an improvement to meet approved standards by waste treatment alone would be much more costly than would instream aerators. (Whipple-Rutgers)
W71-03226

ESTABLISHMENT AND OPERATION OF METROPOLITAN SEWERAGE COMMISSIONS.
For primary bibliographic entry see Field 06E.
W71-03262

BRUSH V LEHIGH VALLEY COAL CO (LIABILITY FOR COAL WASTE DEPOSITION).
For primary bibliographic entry see Field 06E.
W71-03266

THE MERCURY POLLUTION PROBLEM IN MICHIGAN AND THE LOWER GREAT LAKES AREA (A SUMMARY OF INFORMATION AND ACTION PROGRAMS),
Michigan Water Resources Commission, Lansing.
W. G. Turney.
May 1970. 12 p, 10 ref.

Descriptors: *Michigan, *Water pollution, *Pollution abatement, *Chemical wastes, Pollutants, Pollutant identification, Investigations, Water pollution sources, Governments, Water pollution effects, Water pollution control, Legal aspects, Lake Erie, Great Lakes, Ecology, Laboratories, Laboratory tests, Fish, Fishkill, Fish conservation, Metals.
Identifiers: *Mercury pollution.

The mercury pollution problem in the St. Clair River, Lake St. Clair, the Detroit River, and Lake Erie is surveyed. Data gathered by numerous agencies within various governments is compiled and there is a preliminary assessment of the problem. The report attempts to show how Michigan learned of the problem, what action has been taken, what action is planned, and what further needs to be done. An historical review of mercury contamination and investigative work in Japan, Sweden and Canada is presented. The clinical symptoms of mercury poisoning in man are enumerated and mercury uptake by fish discussed. The results of laboratory testing for mercury concentrations in fish by various governmental laboratories are revealed. The report discloses action programs by the Michigan Water Resources Commission relating to the control of mercury discharges. Action has been taken against Wyandotte Chemical Company, and General Electric Company, the mjaor Michigan mercury pollution sources. (Powell-Florida)
W71-03294

06. WATER RESOURCES PLANNING

6A. Techniques of Planning

WATER INFLOW COMPUTATION OF THE PLANNED ANKARA CERKESHOYUK RESERVOIR,
Topraksu Central Research Inst., Ankara (Turkey).
For primary bibliographic entry see Field 04A.
W71-02804

AN ASSESSMENT OF OPTIMIZATION TECHNIQUES AS APPLIED TO WATER RESOURCE SYSTEMS,
Environmental Dynamics, Inc., Los Angeles, Calif.
John A. Dracup, Fereidoun Mobasheri, and Miguel A. Cardenas.
Available from NTIS as PB-196 361, $3.00 in paper copy, $0.95 in microfiche. Research Project Report, August 1970. 170 p, 4 fig, 331 ref, 3 append. OWRR Project X-103 (No 1996) (1).

Descriptors: Optimization, Optimum development plans, Planning, *Review, Bibliographies, *Systems analysis, Water resources development, *Model studies, *Hydraulic systems, *Water storage, *Water conveyance, *Groundwater, *Conjunctive use, *Water quality control, *Desalination.
Identifiers: Optimization techniques, Data management.

The research undertaken in the use of Optimization Techniques in the analysis of water resources systems is assessed. The most significant research in five important areas is covered; hydrologic systems; surface water storage and conveyance systems; groundwater and conjunctive groundwater systems; water quality control systems; and desalination systems. The areas of modeling and data management as they apply to water resources are discussed. The significant water resources problems to which researchers in systems analysis have addressed their efforts and the historic development of the use of system analysis techniques in each of these areas is presented. The value of this research and the extent to which current research efforts are solving the identified problems are presented. Current research and development needs and their priorities are delineated in each of the five areas.
W71-02878

ECONOMIC AND TECHNICAL ASPECTS OF THE USE OF MATHEMATICAL MODELS IN STATE WATER RESOURCES PLANNING PROGRAMS,
Nebraska Univ., Lincoln. Water Resources Research Inst.
Warren Viessman, Jr.
Available from NTIS as PB-196 365, $3.00 in paper copy, $0.95 in microfiche. Publication No 3, Water Resources Research Institute, Univ. of Nebraska, Project Completion Report, June 1970. 10 p, 197 ref, 1 append. OWRR Project A-016-NEB (1).

Descriptors: *Mathematical models, *Water resources, *Planning, Cost, Computer programs, Economics, Technical feasibility, Nebraska, *Model studies, Water resources development.

This project was designed to explore the economics of instituting a serious modeling effort within a state water planning agency and to assess the technical limitations on the use of current models for solving planning-oriented problems. The state of Nebraska was used as a case study. The research effort concentrated on two aspects of the modeling approach to state water resources planning - namely the cost of developing and sustaining such programs and the effectiveness expected. Included were minimal professional requirements to conduct an adequate program at various levels such as: (a) use of existing models and computer programs; (b) refinement and improvement of existing models and computer programs to meet specific needs and (c) the development of new models and modeling techniques. This phase provided guidelines by which costs of state water resources planning resulting from a modeling approach can be assessed. The second phase reviewed the current efforts in mathematical modeling relative to their applicability to water resources planning problems. Has 197 references. (Kriss-Cornell)
W71-02879

MAXIMUM UTILIZATION OF SCARCE DATA IN HYDROLOGIC DESIGN,
Corps of Engineers, Sacramento, Calif. Hydrologic Engineering Center.
For primary bibliographic entry see Field 07C.
W71-02919

DETERMINATION OF PROBABILITY DISTRIBUTION OF MAXIMUM DISCHARGES ON THE BASINS OF ALL OBSERVED FLOODS,
Technical Univ. of Warsaw (Poland).
For primary bibliographic entry see Field 02E.
W71-02929

IMPROVED PRECISION OF FUTURE HIGH FLOODS,
Central Water and Power Research Station, Poona (India).
For primary bibliographic entry see Field 02E.
W71-02930

COST-BENEFIT ANALYSIS FOR INLAND NAVIGATION IMPROVEMENTS,
Northwestern Univ., Chicago, Ill. Econometrics Center.
For primary bibliographic entry see Field 06B.
W71-02981

TIME SEQUENCING OF ELEMENT CONSTRUCTION IN A MULTI-RESERVOIR SYSTEM,
Water Resources Engineers, Inc., Springfield, Va.
G. K. Young, J. C. Moseley, and D. E. Evenson.
Water Resources Bulletin, Vol 6, No 4, p 528-541, July-August 1970. 32 p, 5 fig, 1 tab, 5 ref.

Descriptors: *Optimization, *Simulation analysis, *Computer programs, *Time series analysis, *Multi-purpose reservoirs, Economics, Constraints, Canals, Monte Carlo method.

The objective of this paper was to describe a computer-oriented procedure for aiding resource planners concerning construction staging decisions about reservoirs and canals. The scheme depended upon rapid computer solutions of a simulation which was constructed to represent the physical and economic response of the water system over time. The objective was to minimize the economic variable subject to the constraint that increasing demands over time were satisfied. The physical or engineering answers to the problem were the points in time at which the reservoirs and canals became functioning members of the overall system. Monte Carlo experiments upon multiple artificial reservoir inflow data were required to determine risks. The surface water transfer and storage system was described by a set of canals which join reservoir and demand points. The scheme considered an ultimate network geometry which was prespecified. There were two reservoir capacities at each site: zero or design capacity. Inflows and demands were also prespecified with the time interval for these variables as one month. The time frames for construction decisions on reservoirs and canals was one year. The decision variable set was comprised of reservoir and canal start times. The response evaluation required a computer simulation model which performed an economic feasibility study for each combination of decision variables. (Kriss-Cornell)
W71-03069

THE ESTUARINE VERSION OF THE COLHEAT DIGITAL SIMULATION MODEL,
Battelle Memorial Inst., Richland, Wash. Pacific Northwest Labs.
D. G. Daniels, J. C. Sonnichsen, and R. T. Jaske.
AEC Research and Development Rep, BNWL-1342, UC-70, Waste Disposal and Processing, June 1970. 40 p, 26 fig, 7 ref.

Descriptors: *Simulation analysis, *Digital computers, *Estuaries, Spatial distribution, Temporal dis-

tribution, Physical properties, River flow, Columbia River.

The COLHEAT simulation model, developed jointly on Division of Production and Division of Reactor Development and Technology funds for the Atomic Energy Commission, was modified to simulate spatial and temporal variations of temperature, chemical, and radionuclide concentration above the salt intrusion in coastal plain estuaries where the river flow is dominant. This report explained these modifications and described a case study on the Columbia River estuary. The major modifications of the existing COLHEAT model which were necessary to develop an estuarine version were performed on: (a) spatial variations in flow; (b) water transport and (c) partial mixing. The primary objective of the case study was to examine the interaction of tow plants along the lower Columbia River estuary. The steps included were river stage determination, river flow calculation, partial mixing and temperature simulation. (Kriss-Cornell)
W71-03070

RAINFALL DISTRIBUTIONS AND SIMULATION MODELS,
University of New England, Armidale (Australia).
For primary bibliographic entry see Field 02B.
W71-03071

SYMPOSIUM: COST BENEFIT ANALYSIS - SPATIAL AND TEMPORAL ALLOCATION OF IRRIGATION WATER: SOME POLICY MODELS AND EXAMPLES,
University of New England, Armidale (Australia); and Guelph Univ. (Ontario).
For primary bibliographic entry see Field 03F.
W71-03072

MATHEMATICAL MODELING OF GULF COAST ESTUARIES,
Texas A and M Univ., College Station. Dept. of Civil Engineering.
For primary bibliographic entry see Field 05G.
W71-03074

SPURIOUS CYCLES IN WATER RESOURCES SYSTEMS,
Kansas State Univ., Manhattan. Dept. of Economics.
Arlo W. Biere.
Water Resources Bulletin, Vol 6, No 6, p 885-892, November-December 1970. 8 p, 4 fig, 11 ref.

Descriptors: *Time series analysis, *Statistical models, *Streamflow forecasting, Statistics, Statistical methods, Stochastic processes, Water management (Applied), Reservoir design, Reservoir operation, Analytical techniques.
Identifiers: *Streamflow analysis.

Analytical procedures for deducing from annual streamflow data information required for water resources systems planning are reviewed. The procedures rely on two techniques to determine the extent that cycles exist in annual time series data. The first is to observe how the time series behaves around the mean annual flow. If it tends not to move across the mean frequently, it is concluded that a cyclical nature exists. The second technique is to observe the time path of accumulated departures from the mean annual flow. The validity of both techniques is questioned, the first because it uses mean flow as 'normal' or the flow that the time series should fluctuate around, and the second because the accumulated departure from the mean time series will be autocorrelated even when the individual annual or seasonal flow observations are uncorrelated. Alternative analytical techniques, which find no cycles, are suggested. (Knapp-USGS)
W71-03124

A SYSTEMS STUDY OF STORM RUNOFF PROBLEMS IN A NEW TOWN,
Hittman Associates, Columbia, Md. Environmental Sciences and Engineering Dept.
Charles W. Mallory, and John J. Boland.
Water Resources Bulletin, Vol 6, No 6, p 980-989, November-December 1970. 10 p, 4 tab, 7 ref. EPA-WQO Grant 15030FM, Contract 14-12-20.

Descriptors: *Storm runoff, *Urbanization, *Systems analysis, *Simulation analysis, Mathematical models, Computer models, Maryland, Water pollution control, Water supply, Optimization, Computer programs, Water reuse, Sediment control.
Identifiers: *Columbia (Md), *Urban hydrology.

A system study was conducted on the use of a large number of small reservoirs dispersed throughout an urban community as a means of storm water pollution control. The study was based on an area within the 'new city' of Columbia, Maryland. Water collected and stored in the reservoirs is treated for release or use in meeting subpotable and potable water demands in the community. Design and performance criteria were developed for such a system. A simulation model and a computerized evaluation technique were used to select the optimal locations and system configurations. The results of this study indicated that such a system would be less expensive than a conventional engineering approach to storm water pollution control. Further, the benefits derived from use of the storm water as a water supply can offset a portion of the cost of pollution control. Several secondary benefits also result from this concept including erosion and sediment control, storm flow dampening, and recreational facilities. A program is now underway to demonstrate this concept in Columbia, Maryland. (Knapp-USGS)
W71-03125

ECONOMICS OF CANNERY WASTE TREATMENT,
Water Resources Engineers, Inc., Walnut Creek, Calif.
For primary bibliographic entry see Field 05D.
W71-03219

OPTIMAL POLICY FOR RESERVOIR OPERATION,
California Univ., Los Angeles. School of Engineering and Applied Science.
Ricardo C. Harboe, Fereidoun Mobasheri, and William W. Yeh.
Journal of the Hydraulics Division, Proceedings, American Society of Civil Engineers, Vol 96, No HY-11, p 2297-2308, November 1970. 3 fig, 4 tab.
OWRR Project No B-061-CAL.

Descriptors: *Reservoir operation, *Dynamic programming, *Multiple-purpose reservoirs, *Decision making, *Water policy, *Water quality control, Water control, Economics, Reservoir design, Reservoirs, Optimum development plans, Long-term planning, Multiple-purpose projects, River basin development, Water resources development, Optimization, Control, Planning, Administration, Evaluation, Management.
Identifiers: *Folsom Reservoir, California.

A modified dynamic programming model based on an alternative objective function useful in determining optimum long range operating policy for a single multi-purpose reservoir is presented. Reservoir uses which are included in the program are: water supply, peak and dump energy supply, and flood and water quality control downstream from the dam. The physical objective is the determination of optimum monthly releases, and monthly storage contents of the reservoir. The economic objective is the maximization of annual equivalent revenue from the operation. In order to keep computer time to a minimum, the dimensionality of the problem was decreased by reducing certain variables to parameters. In this way the dynamic programming was reduced to finding optimum monthly water releases from the reservoir so that revenue from power production is maximized. The program was demonstrated on the Folsom Reservoir on the American River in Northern California. Historical stream flow data were used, but it was concluded that other types of data could be applied equally well. The program can be easily expanded to include other reservoir uses through the use of additional parameters. It is suggested that the program could be used as a subroutine in a design problem by converting parameters such as power plant and reservoir capacity to decision variables. (Hewett-Rutgers)
W71-03220

6B. Evaluation Process

MERCER COUNTY, NEW JERSEY, COMPREHENSIVE PLAN: ANALYSIS OF WATER SUPPLY AND SEWERAGE FACILITIES OF MERCER COUNTY.
Mercer County Planning Board, Trenton, N.J.
For primary bibliographic entry see Field 05D.
W71-02834

EXPORT OF MISSISSIPPI RIVER WATER TO TEXAS AND NEW MEXICO,
Bureau of Reclamation, Austin, Tex.
H. P. Burleigh.
Journal of the American Water Works Association, Vol 62, No 6, p 367-375, June 1970. 9 p.

Descriptors: Planning, *Project planning, Project benefits, *Surplus water, Project feasibility, *Water resources development, Legal aspects, New Mexico, Inter-agency cooperation, Water transfer, Texas, Louisiana, Groundwater recharge, Mississippi River, Investigations, Irrigation water, Water management (Applied), Public benefits.
Identifiers: *Interbasin water transfer, Mississippi River Commission, Water-use study.

The possibility of exporting surplus water from the Lower Mississippi River to Texas and New Mexico is increasing with the decrease in groundwater resources available to these states. Four viewpoints examining this possibility are: (1) Federal studies, (2) the Mississippi River Commission studies, (3) the State of Louisiana Department of Public Works studies, and (4) the State of Texas Water Development Board studies. No water project in history remotely approaches the size of the import project needed to maintain the economy of the Texas-New Mexico area. The project cannot be planned and developed solely as a water supply for western Texas and eastern New Mexico. There is no assurance that a single drop of Mississippi River water will ever be available for export. Such assurance would require the concurrence and support of the states that depend on the Lower Mississippi River system to sustain major sections of their economies. To obtain the cooperation of those states, the project is being conceived as a truly interregional undertaking that will provide benefits from one end to the other and not solely in western Texas and eastern New Mexico. (USBR)
W71-02852

CLIMATES OF WEST PAKISTAN ACCORDING TO THORNTHWAITE'S SYSTEM OF CLASSIFICATION OF CLIMATES,
For primary bibliographic entry see Field 02A.
W71-02869

THE IMPACT OF DIFFERENT LEVELS OF WATER DEVELOPMENT ON TEXAS AGRICULTURE,
Texas Agricultural Experiment Station, College Station.
For primary bibliographic entry see Field 03F.
W71-02876

WATER RESOURCES AND REGIONAL LAND-USE PLAN,
Harza Engineering Co., Chicago, Ill., Water Resources Planning Div.
James C. Ringenoldus.
ASCE Proceedings, Journal of the Sanitary Engineering Division, Vol 96, No SA 6, Paper 7735, p 1311-1320, December 1970. 10 p, 3 ref.

Descriptors: *Water resources development, *Land use, *Planning, Urbanization, Sanitary engineering, Water pollution, Natural resources, Water pollution control.
Identifiers: *Regional planning, Economic analysis.

Water resources development and management plans for urbanizing areas must be prepared within the framework of a regional land-use plan if the water resource is to be preserved, protected, and utilized efficiently. Land and water resource planning should be concurrent and interacting so that land use does not exceed the capability of the water resource base and so development of water resources can best serve the urban community. Water resources plans for urban areas should include consideration of all purposes and retain maximum flexibility for future decisions. A recommended planning procedure includes the following steps: study design, establishment of objectives principles and standards, inventory, analysis and forecast, formulation of alternative plans, plan test and evaluation, and plan selection. The selection of the plan to be adopted is the prerogative of the public, and the planner is responsible for formulating viable alternatives from which selection can be made. (Woodard-USGS)
W71-02903

WATER RESOURCES DEVELOPMENT IN EAST PAKISTAN,
East Pakistan Water and Power Development Authority, Dacca.
For primary bibliographic entry see Field 04A.
W71-02915

COUNTRY REPORT FOR PAKISTAN,
Irrigation, Drainage and Flood Control Research Council, Rawalpindi (Pakistan).
M. Anis Ahmed.
In: Proceedings of Central Treay Organization Seminar on Evaluation of Water Resources With Scarce Data, March 4-8, 1969, Tehran, Iran, p 57-73, January 1970. 17 p, 2 fig, 5 tab.

Descriptors: *Water resources development, *Foreign projects, *Programs, Hydrologic data, Gaging stations, Precipitation (Atmospheric), Evaporation, Temperature, Solar radiation, Humidity, Atmospheric pressure, Wind velocity, Sediments, Decision making.
Identifiers: *Pakistan, Scarce data.

Geographic and hydrologic conditions for East and West Pakistan are described and summaries of the hydrological stations, instrumentation, quality of the data, and hydrological forecasting from scarce data are given. Separated by 1,000 mi of Indian territory, the two parts of Pakistan differ very much in climate, language, topography, and water resources. The plains, plateaus, and mountains through which the Indus River and its 5 major tributaries flow in West Pakistan contrast with the alluvial plain of the Ganges, Brahmaputra and the Meghna which combined form the largest delta in the world on which East Pakistan is situated. The vast arid and desert region of the West contrasts with the humid and hot climate with heavy rains in East Pakistan. The Indus Basin is faced with problems of waterlogging, salinity, and alkalinity, aggradation of river bed, and periodic floods. East Pakistan is plagued by recurring floods, droughts, and cyclones for which systematic hydrological surveys are needed for basin planning and management operations. Different agencies are making observations, mostly for precipitation and temperature data, but a few gaging and discharge measuring stations are operated at important places. The Directorate of Hydrology maintains 228 stations for recording rainfall, evaporation, temperature; 123 of which are for stream gage and discharge sites. (Lang-USGS)
W71-02916

COUNTRY REPORT FOR UNITED KINGDOM,
Water Resources Board, Reading (England).
N. A. F. Rowntree.
In: Proceedings of Central Treaty Organization Seminar on Evaluation of Water Resources With Scarce Data, March 4-8, 1969, Tehran, Iran, p 75-86, January 1970. 12 p, 2 fig, 1 tab, 15 ref.

Descriptors: *Water resources, *Programs, *Planning, Rainfall, Runoff, Evaporation, Surface water, Groundwater, Telemetry, Reservoir storage, Hydrographs, Watershed management, Hydrologic data.
Identifiers: *United Kingdom, Scarce data.

The majority of water conservation schemes in the United Kingdom have until the present time been designed on the basis of scarce data. In 1963, a Water Resources Board was set up to guide water resources planning and development at national level for England and Wales and operation through River Authorities organized on a natural catchment area basis. Each river authority is responsible for hydrometric development within the area. In this paper the principal ways in which hydrometric data are regarded as scarce were considered and the ways in which the scarcity can be overcome and made good for water resource assessment are outlined. Data may be scarce for a particular variable. For example, rainfall may have been measured, but not runoff or evaporation; data periods are too short or not sufficiently representative or not accurate enough for the needs. Automatic recording instrumentation is being accomplished through the new scheme of the Water Resources Board. A third of the 1,500 new rain gages will record on magnetic tape the measured rainfall and time intervals. Punched tape digital recorders for water level are being installed as standard at most stream-gaging sites and on groundwater observation wells. (Woodard-USGS)
W71-02917

COST-BENEFIT ANALYSIS FOR INLAND NAVIGATION IMPROVEMENTS,
Northwestern Univ., Chicago, Ill. Econometrics Center.
Leon N. Moses, Lester B. Lave, James P. Stucker, William B. Allen, and Michael V. Beuthe.
Institute for Water Resources, Report 70-4, October 1970, Vol I, 63 p; Vol II, 773 p; Vol III, 474 p. Dept of the Army, Corps of Eng. DA-49-129-CIVENG-65-23.

Descriptors: *Cost-benefit analysis, *Cost analysis, *Benefits, Costs, Project planning, Cost allocation, *Multiple-purpose projects, *Navigation, Planning, Water resources development, *Water policy, *Transportation, *Inland waterways, Highways, Railroads, *Water supply, *Water demand, Water costs, Water requirements, Supply, Demand.
Identifiers: Transportation alternative, Transportation demand, Modal split, Discriminant analysis, Regression analysis, Transportation benefits, National income benefits, Process cost functions, Line haul cost functions, Joint costs, Production function of transportation modes, Engineering cost functions, Statistical cost functions, Intermodal competition, Private costs, Public costs, Externalities, Regulatory behavior.

This report contains (1) summary report, (2) demand and cost analysis, and (3) regulatory policy and intermode competition. Past discussions of the alternative ways of measuring the benefits of navigation improvements have centered around three techniques. Two of these techniques are based on rate comparisons: The method legislated by Congress as part of the bill creating a Department of Transportation uses projected rates for water transportation and existing rates for its competitors; the projected rate method uses expected rates for water transportation and its competitors. Both techniques are incorrect in the sense that they measure transfers of income from some groups to other groups rather than economic benefits. The third method focuses on the long run cost functions of the modes. It defines the benefit of a navigation improvement as the reduction in the total (present) value of resources, whether provided by government or private firms, that society can withdraw from transportation while still satisfying transportation demands. If all commodities have transportation demand functions that are perfectly inelastic, the method is essentially correct but somewhat incomplete. It ignores certain costs, such as the cost of time, that are inherent in transportation but are not part of carriers' cost functions. The cost method should be modified and these indirect costs taken into account. Failure to do so biases the measurement of benefits in favor of water transportation, because this mode tends to have an advantage in carrier costs but a disadvantage in other costs. The pure cost approach, which ignores indirect costs, can lead to the construction of uneconomic projects. Transportation demand functions appear to be highly, but not perfectly inelastic. Navigation improvements that reduce costs of transportation will, therefore, cause the tonnage shipped to increase somewhat. The assumption that total tonnage is fixed at any given point of time does not rule out the possibility of considering trend increases. It does tend, however, to understate the benefits of improvements. The advantages of the assumption are that it greatly reduces the complexity of project evaluation or its vagaries.
W71-02981

A CRITIQUE OF FEDERAL WATER RESOURCES POLICIES: HYDROELECTRIC POWER VERSUS WILDERNESS WATERWAY ON THE UPPER MISSOURI RIVER,
Cornell Univ., Ithaca, N.Y.
Carlos David Stern.
PhD Thesis, Cornell University, 2 vols, February 1971. 735 p, 64 tab, 30 fig. OWRR Project A-024-NY (1).

Descriptors: *Water policy, *Water resources development, Legislation, Governments, *Hydroelectric power, *Costs, Hydroelectric plants, Hydroelectric project licensing, Electric power, Recreation, Flood control, Cost-benefit analysis, *Cost allocation, *Missouri River, Cost analysis, *Federal project policy.

The purpose was to evaluate a particular Federal report in terms of its usefulness to decision-makers and to the public. Since the Joint Report for Development of the Reach of the Missouri River Between Fort Peck and Fort Benton was intended to serve as a reliable guide to Congress in reaching a decision concerning the fate of the last natural reach of a major U.S. river, it was found to be particularly well suited to serve as a case study. This thesis is organized into two parts: Part I deals with the historical and political background: a discussion of the Missouri River Basin development since 1944, a presentation of the setting against which the benefits of the proposed projects are tested in Part II, and a look at what actions followed the release of the Joint Report after 1963 and up to the present. While Part I deals primarily with the social and political context, Part II is a critique of the benefits and the costs of the various projects in the Joint Report. The discussion of benefits focuses on: electric power, replacement flood control and recreation. The discussion of costs includes an evaluation of some components of the original cost estimates and a discussion of omissions from the Joint Report. There is throughout Part II an ongoing attempt to relate benefits to costs on the basis of the revised data, in order to demonstrate the sensitivity of the outcome to shifts in some key factors such as hydroelectric plant factor, discount rate, and stream flow.
W71-03016

SYSTEM ECONOMIC RESPONSE TO WATER QUANTITY AND QUALITY - FUNDAMENTAL CONSIDERATIONS,
Utah Water Research Lab., Logan.
D. W. Hendricks, N. P. Dixon, and R. S. Whaley.
Water Resources Bulletin, Vol 6, No 4, p 682-694, July-Aug 1970. 13 p, 8 fig, 1 tab, 4 ref.

Descriptors: *Systems analysis, *Water quality, *Water supply, *Optimization, *Economics, Water allocation (Policy), Utah.
Identifiers: Total net benefits, Algorithm, Little Bear River.

A systems analysis approach for assessing the economic effect of both the quantity and quality of water was outlined. The allocative problem was considered as a joint production model. The first phase was to allocate between extensive and intensive factors of production within a water use and then, using the optimum mix of these two categories of variables for each use (called 'the intensive effect') to allocate water quantity and quality between the various uses (called 'the extensive effect'). The results of various alternative policy decisions were then assessed in terms of economic criteria. The relationship between water quantity, water quality and system economic response to permutations of these variables on any given water use, and the allocation of water among competing uses was outlined by means of a conceptual model. The whole system was evaluated for its different permutations in water use by Total Net Benefits (TNB). The Little Bear River system in the south of Cache Valley in Northern Utah was the subject of a river basin quality-quantity modeling project used as a case study. It illustrated application of the general algorithm for net benefits. The analytical approach for assessing net benefits for various mixes of land (or miles of trout system) and applied water for irrigation of barley and trout production respectively was shown. (Kriss-Cornell)
W71-03067

SYMPOSIUM: COST BENEFIT ANALYSIS - SPATIAL AND TEMPORAL ALLOCATION OF IRRIGATION WATER: SOME POLICY MODELS AND EXAMPLES,
University of New England, Armidale (Australia); and Guelph Univ. (Ontario).
For primary bibliographic entry see Field 03F.
W71-03072

ANALYSIS OF TOURISM AND RECREATION POTENTIAL OF MERAMEC PARK RESERVOIR REGION IN MISSOURI.
Economic Research Associates, Los Angeles, Calif.

Available from NTIS as PB-189 053, $3.00 in paper copy, $0.95 in microfiche. March 1969. 280 p.

Descriptors: Missouri.
Identifiers: *Recreation, Feasibility studies, Economics, Commerce, Tables, Costs, *State parks, *Meramec Park Reservoir.

The objective of the study was to identify feasible travel and recreation attractions for development on those publicly owned lands which are expected to be located around the reservoir. Specifically, it included: (1) Completion of a comprehensive and detailed inventory and analysis of travel and recreation activity in the state, and more specifically in the Meramec Park Reservoir area; (2) Consumer market research to determine the recreation needs of residents of the area as well as travelers who currently visit the Meramec Park Reservoir region or can be expected to visit there in the future; and (3) Identification of recreation and visitor attractions which have potential for possible development in the designated area.
W71-03077

REGIONAL AND LOCAL LAND USE PLANNING VOLUME IV.
Public Land Law Review Commission, Washington, D.C.

Available from NTIS as PB-189 413, $3.00 in paper copy, $0.95 in microfiche. Study Report No. 10, February 1970. 164 p.
Identifiers: *Management planning, Natural resources, *Economics, *Law, Maps, Employment, Climatology, Terrain, Soils, Minerals, Water supplies, Site selection, Tables, Land use planning, Regional planning and development, *Public land.

Economic profiles; (Region I Los Angeles Las Vegas, Region II. Pacific Northwest Region III. Upper Rocky Mountains, Region IV, Blue Ridge - Shenandoah); Comprehensive general plan outline comparison table. (See also W71-03078)
W71-03079

A METHODOLOGY FOR EVALUATION OF THE ECONOMIC DEVELOPMENT OF THE ADMINISTRATION'S PUBLIC WORKS PROGRAMS.
EBS Management Consultants, Inc., Washington, D.C.

Available from NTIS as PB-189 676, $3.00 in paper copy, $0.95 in microfiche. May 1969. 117p.
Identifiers: *Economics, *Urban planning, *Federal budgets, Effectiveness, Reviews, Commerce, Employment, Water supplies, Sanitary engineering, Roads, Hospitals, Education, Recreation, Seacost Organizations, Questionnaires, Low Income families, Economic development, Industrial parks, Ports, Evaluation, Public works programs.

The report presents the results of preliminary studies conducted for the Economic Development Administration (EDA) to prepare a methodology for the evaluation of public facility projects. The EDA public works program has provided financial assistance since early 1966 for the construction of various types of public facilities for the purpose of assisting certain designated areas in improving the opportunities for the successful establishment or expansion of industrial or commercial plants or facilities; in otherwise helping to create long-term employment opportunities; or in providing benefits for those who have been unemployed for a long time or who come from low income families.
W71-03086

CENTRAL OREGON COAST, VOLUME I. PHYSICAL CONDITIONS AND PRESENT DEVELOPMENT.
Oregon Univ., Eugene. Bureau of Governmental Research and Service.

Available from NTIS as PB-188 731, $3.00 in paper copy, $0.95 in microfiche. 1969. 46 p.
Identifiers: Management planning, *Oregon Terrain, Soils, Climatology, Drainage, Tides, Hydrology, Seacoast, Law, Urban areas, *Central Coast Region, Oregon, *Regional planning and development, Land use, Land titles, Watersheds, Subdivision regulations.

Location, Topography, Geology and soils: Climate: Watersheds and drainage; Land ownership; Land use: Regulatory codes and ordinances; and Implications for further development. (See also W71-03200 thru W71-03207)
W71-03199

CENTRAL OREGON COAST. VOLUME II. ECONOMIC PATTERNS.
Oregon Univ., Eugene. Bureau of Governmental Research and Service.

Available from NTIS as PB-188 732, $3.00 in paper copy, $0.95 in microfiche. 1969. 58 p.
Identifiers: *Management planning, *Oregon, *Economics, Management planning, Seacoast, Forestry, Agriculture, Recreation, Mining engineering, Fishes, Harbors, Commerce, Natural resources, Scientific research, Employment, Wages, Industries, *Central Coast Region (Oregon), *Regional planning and development, Land titles, Fisheries.

General economic forces: Natural resource economy; Jobs and development: Employment potentials. (See also W71-03199)
W71-03200

CENTRAL OREGON COAST, VOLUME III, FOREST PRODUCTS INDUSTRY.
Oregon Univ., Eugene. Bureau of Governmental Research and Service.

Available from NTIS as PB-188 733, $3.00 in paper copy, $0.95 in microfiche. 1969. 49 p.
Identifiers: *Management planning, *Oregon, *Industries, Wood, Forestry, Trees, Economics, Employment, Predictions, Seacoast, *Central Coast Region (Oregon), *Lumbering, *Wood products industry, *Regional planning and development, Public land, Land titles.

Forest resources; Timber supply and log flows; Forest products establishments and employment; Employment forecasts for the wood products industry. (See also W71-03199)
W71-03201

CENTRAL OREGON COAST. VOLUME IV. AGRICULTURE.
Oregon Univ., Eugene. Bureau of Governmental Research and Service.

Available from NTIS as PB-188 734, $3.00 in paper copy, $0.95 in microfiche. 1969. 51 p.
Identifiers: *Management planning, *Oregon, *Agriculture, Management planning, Production, Employment, Industries, Commerce, Periodic variations, Economics, Transportation, Animals, Rural areas, Advanced planning, *Central Coast Region (Oregon), *Regional planning and development, Agricultural products, Crop diversification, Land use, Marketing, Livestock.

This report outlines some of the factors contributing to the future development of agriculture in the area, presents a quantitative estimate of the land requirements involved, evaluates the impact of agriculture upon the present and future economy of the area, and finally makes some more or less specific suggestions relative to lands that should be reserved for various agricultural purposes. (See also W71-03199)
W71-03202

CENTRAL OREGON COAST, VOLUME V. COMMERCIAL FISHING AND FISH PROCESSING.
Oregon Univ., Eugene. Bureau of Governmental Research and Service.

Available from NTIS as PB-188 735, $3.00 in paper copy, $0.95 in microfiche. 1969. 37 p.

Descriptors: *Management planning, *Oregon, *Industries, *Seafood, Economics, Commerce, Harbors, Processing, Fishes, Crustacea, Pelcypoda, Automation, Employment, Scientific research, Advanced planning, Seacoast.
Identifiers: *Central Coast Region (Oregon), *Commercial fishing, *Regional planning and development, Fish processing, Fisheries, Marine fishes, Food industry, Marketing, Salmon, Tunas, Market value.

The fisheries industry, as defined for purposes of this study, includes commercial fishing, commercial fish processing, and the wholesale and retail distribution of fish. It is the third most important industry in the four-county coastal strip area covered under the study; it is an 'export industry' of the area. Although an analysis of the demand and supply factors affecting the fisheries industry na-

tionally and regionally can be related to the four-county coastal area covered under this study only in a very general way, it serves as a useful framework within which to undertake this study. The fisheries industry as it functions within the study area is not an economic microcosm of the industry nationally; however, characteristics of the production and marketing problems of the industry are similar on the local, regional, and national scale. As is shown later on, the economic impact of fisheries in the study area generally reflects those characteristics which mark the industry on the larger scale. (See also W71-03199)
W71-03203

CENTRAL OREGON COAST. VOLUME VI. RECREATION TOURISM.
Oregon Univ., Eugene. Bureau of Governmental Research and Service.

Available from NTIS as PB-188 736, $3.00 in paper copy, $0.95 in microfiche. 1969. 79 p.

Descriptors: *Recreation demand, *Recreation facilities, Social needs, Land use, Water utilization, *Tourism, Camping, Boating, Parks.
Identifiers: Oregon coasts.

Criteria for development; Use and demand; Existing facilities and potentials and development; Responsibilities for recreation. (See also W71-03199)
W71-03204

CENTRAL OREGON COAST. VOLUME VII. POPULATION AND HOUSING.
Oregon Univ., Eugene. Bureau of Governmental Research and Service.

Available from NTIS as PB-188 737, $3.00 in paper copy, $0.95 in microfiche. 1969. 29 p.

Descriptors: *Management planning, *Oregon, *Population, Growth, *Housing, Abundance, Predictions, Advanced planning, Seacoast, Recreation, Sociology, Economics, Employment.
Identifiers: *Central Coast Region (Oregon), *Regional planning and development, Demography, Socioeconomic status, Vacation homes.

Contents: Population trends 1950-1967; Population characteristics; Population forecasts; Housing trends and distribution; Forecast of 1985 housing needs; Implications for future development. (See also W71-03199)
W71-03205

CENTRAL OREGON COAST. VOLUME VIII. TRANSPORTATION AND UTILITIES.
Oregon Univ., Eugene. Bureau of Governmental Research and Service.

Available from NTIS as PB-188 738, $3.00 in paper copy, $0.95 in microfiche. 1969. 52 p.
Identifiers: *Management planning, *Oregon, *Transportation, Management planning, Shipping (Marine), Railroads, Air transportation, Cargo, Cargo vehicles, Harbors, Terminal flight facilities, Traffic, Roads, Water supplies, Sanitary engineering, Electric power production, Fuels, Advanced planning, *Central Coast Region (Oregon), *Public utilities, *Regional planning and development, Sanitary sewers, Natural gas, Land use.

Ports and shipping; Highway transportation; Rail transportation; Air traffic system; Utilities. (See also W71-03199)
W71-03206

CENTRAL OREGON COAST. VOLUME IX: DEVELOPMENT PROBLEMS AND POTENTIALS.
Oregon Univ., Eugene. Bureau of Governmental Research and Service.

Available from NTIS as PB-188 739, $3.00 in paper copy, $0.95 in microfiche. 1969. 17 p.

Descriptors: *Management planning, *Oregon, Problem solving, Advanced planning, Growth, Substitutes, Sociology, Economics, Natural resources, Recreation, Housing, Harbors, Shipping (Marine), Scientific research, Seacoast, Education, Organizations.
Identifiers: *Central Coast Region (Oregon), *Regional planning and development, Recommendations.

The first eight reports of this study (PB-188 731 through PB-188 738) of the central coast area each deal with some specific subject that is of particular importance to planning for the future development of the region. These reports indicate that the central coast of Oregon is richly endowed with many resources, and that the development of these resources is of importance to the region, the state, and the country. It is also apparent that there are some inherent developmental conflicts and problems that should be considered when planning decisions for the area are made. The purpose of this report is to summarize certain findings contained in the eight subject matter reports which indicate the probable characteristics of growth and change in the study area during the next twenty years. In addition, some implications of alternate specific development policies are noted in terms of their impact on all aspects of growth. (See also W71-03199)
W71-03207

A SOCIO-ECONOMIC STUDY OF NARRAGANSETT BAY, RHODE ISLAND,
Rhode Island Univ., Kingston. Dept. of Food and Resource Economics.
Niels Rorholm, Harlan C. Lampe, and Joseph F. Farrell.
Report (undated). 206 p, 11 fig, 41 tab, 10 charts, 123 ref. FWPCA Contract No 14-12-93.

Descriptors: *Estuaries, *Water resources, Estuarine environment, Economics, Rhode Island, Evaluation, Natural resources, Planning, Regional analysis, Bays, Benefits, Long-term planning, Social impact, Economic impact, Estuarine fisheries, Recreation demand, Recreation, Transportation, Waste disposal, Water resources development, Fisheries, Resources, New England, Multiple purpose.
Identifiers: Narragansett Bay, Marine industry.

Narragansett Bay may be viewed as a natural resource which in combination with labor, capital, and management produces multiple products and services. Products of the Bay which are discussed include commercial fisheries, defense establishments, recreation, bay transportation, marine oriented industry and commerce, research and education, waste disposal, and quality of the environment. Many of these uses compete with one another, others are complimentary, some are complimentary or competitive depending on the degree of use of each. An estuary is a complex of interacting systems and in turn is a part of a larger amalgam of systems relating to human activity. A clear picture of an estuary as a resource can result only from careful study of interacting physical, biological, technical, social and economic factors. It is important that these factors be considered together as much as is possible, and that studies of any one category be oriented such that they relate to and are translatable to the whole. In this way, some insight into the potential of the estuary may be gained, and some foundation laid for rational decision making and management. The integration of the various individual studies of specific areas requires the acknowledgment of and adherence to planning objectives. These objectives cannot be understood without extensive research. (Hewett-Rutgers)
W71-03217

THE NATIONAL WATER COMMISSION, ANNUAL REPORT FOR 1969: INTERIM REPORT NO 1.
National Water Commission, Arlington, Va.

For sale by the Superintendent of Documents, US Government Printing Office, Washington, DC 20402. Price $0.40. December 31, 1969. 73 p, 7 append.

Descriptors: *Water resources, *Water resources development, *Federal government, *Non-structural alternatives, Research and development, Water policy, Water conservation, Administration, Inter-basin transfers, Institutions, Multiple-purpose projects, Cities, Water law, Planning, Project purposes, Legal aspects, Social aspects, Water management (Applied), Water requirements, Water supply, Water utilization.
Identifiers: *Study commissions.

The National Water Commission's annual report for 1969 is a brief summary of the Commission's activities during its first year of existence. The first part of the report deals with the Commission's efforts to determine, with respect to the commission's goals, the reactions, requirements, and reasoning of water resources officials and other leaders in various regions of the United States. The report covers what the Commission learned regarding goals, objectives, priorities, planning, government institutions, water laws, inter-basin transfers, metropolitan areas, and other problems. The second portion of the report deals with information obtained from expert consultants and federal officials in the field of water resources. New trends and possibilities are reviewed. Part three of the report deals with the evaluation and weighing of what had been heard from the various regions and from water resources experts and, based on this information, the formulation of the Commission's study program. The fourth portion of the report describes Commission organization. The appendices contain a report by the Commission's Panel on Ecology and the Environment, dealing with some ecological principles and interactions between uses and the environment. (Powell-Florida)
W71-03295

6C. Cost Allocation, Cost Sharing, Pricing/Repayment

ECONOMIC AND TECHNICAL ASPECTS OF THE USE OF MATHEMATICAL MODELS IN STATE WATER RESOURCES PLANNING PROGRAMS,
Nebraska Univ., Lincoln. Water Resources Research Inst.
For primary bibliographic entry see Field 06A.
W71-02879

HOW TO SELECT AND USE DRILL BITS PROFITABLY,
Delta Drilling Co., Tyler, Tex.
For primary bibliographic entry see Field 08C.
W71-02985

HOW TO CUT COSTS IN EXPLORATION DRILLING,
Miller and York Drilling Inc., Bakersfield, Calif.
C. F. Green.
World Oil, Vol 161, No 1, p 103-105, July 1965.

Descriptors: *Drilling, Exploration, *Contracts, Bids.
Identifiers: *Drilling economics, Drilling costs.

Working knowledge of drilling contracts can help geologists and other exploration personnel to assist in reducing cost of exploratory holes; excessive requests for unnecessary special equipment and drilling contracts with severe deviation limitations are two areas of potential savings. The geologist can assist operational management in selecting and specifying terms of drilling contracts by predicting

drillability of various formations, especially in areas where penetration rates are difficult to predict. The engineer should also be familiar with the different types of drilling contracts in order to plan drilling programs properly. (Campbell-NWWA)
W71-02995

FINANCING WATER SUPPLY AND SEWERAGE PROJECTS IN DEVELOPING COUNTRIES,
International Bank for Reconstruction and Development, Washington, D.C.
Juergen Krombach.
Columbia University Seminar on Pollution and Water Resources, Columbia University, New York, N.Y., September 1970. 26 p, 5 tab.

Descriptors: *Financing, *Loans, *Economics, *Capital, *Water Resources development, Water Supply, Waste water treatment, Public utilities, Project planning, Planning, Evaluation, Economic feasibility, Financial feasibility, Investment, Institutions.
Identifiers: *International Bank for Reconstruction and Development, *World Bank Group, Foreign aid, Bilateral aid, Multilateral aid, Under developed nations.

The objective of the paper is to explain the World Bank's criteria in selecting and appraising water supply, sewerage and other environmental sanitation projects. Bilateral and multilateral aid are discussed. The relative portions donated by various countries, both bilaterally and through multilateral agencies are presented, as well as the relative disbursement to various regions of the world. The various agencies of the World Bank Group are enumerated along with their origins, their functions, the nature of their loans and the sources of their funds. The general criteria for project appraisal by the World Bank Group are presented and discussed with respect to their suitability in relation to the general conditions of under-developed countries. Economic, technical, commercial, financial and institutional aspects of the World Bank's appraisals of various water supply and sewerage projects are presented. Details of policies and expectations of the World Bank are discussed with respect to their effect on the preparation of project plans. The administration of loans and the supervision of active construction projects by the World Bank are discussed. Future aims and interests of the World Bank in the field of water supply and sewerage are presented. (Hewett-Rutgers)
W71-03218

COST OF PROVIDING WATER FOR FIRE PROTECTION,
Jordan (Edward C.), Inc., Portland, Maine.
Donald R. Cote, and Alvin S. Goodman.
Journal American Water Works Association, Vol 62, No 7, p 407-411, July 1970. 2 fig, 3 tab.

Descriptors: *Water costs, *Separable cost allocation, *Cost allocation, Cost analysis, Cost sharing, Separable costs, Cost comparisons, Estimated costs, Costs, Utilities, Project planning, Planning, Rates.
Identifiers: *Fire protection, Rate making.

This study is based on the premise that each function of a water system should be paid for by charges based on the cost of providing the function, and therefore, water systems should be paid for by those who consume water and by those who are afforded fire protection. Three methods of allocating costs are: fire protection as an incremental cost; general service as an incremental cost; and the capacity-ratio method. Because the basic function of most water systems is to supply water for general consumption the first method has been selected as the most reasonable. A study of seven existing water systems was conducted to determine the incremental cost of fire protection. It was found that the incremental cost of fire protection decreases (on a percentage basis) with the increasing size of the system. The relationship between population and percent of total cost for fire protection was very strong. A definite relation between total water consumption and percent of total cost for fire protection also exists. Variables such as the area of the system, and the ratio of peak flows to maximum daily flows were found to be not as important. It is believed that the nature of the systems studied varied enough to make the results of this study applicable to other water systems as a guide line for determining the percent of total cost which may be attributed to fire protection. (Hewett-Rutgers)
W71-03221

A NEW FOCUS IN WATER SUPPLY ECONOMICS - URBAN WATER PRICING,
West Virginia Univ., Morgantown. Coll. of Commerce.
Patrick C. Mann.
Journal American Water Works Association, Vol 62, No 9, p 534-537, September 1970. 1 tab.

Descriptors: *Water rates, *Water costs, *Pricing, Use rates, Rates, Public utilities, Cost analysis, Marketing, Economics, Utilities.
Identifiers: *Rate structures, *Water rate analysis, Principal component analysis.

The rapid growth of urban areas and the increasing scarcity of water supplies have created a need for an economic analysis of urban water pricing. This paper discusses existing water rate structures, the methods by which they are determined, and problems which are encountered in their use. A statistical analysis of urban water prices is also presented. The technique of principal component analysis was used to analyze six measures of urban water price. These included the monthly metered rates for 500 cu ft, 1000 cu ft, 10,000 cu ft, 100,000 cu ft of water, the water revenue per million gallons produced, and the water revenue produced per million gallons sold. Principal component analysis is a statistical factor analysis which determines general patterns of association among variables on the basis of their intercorrelations. For the 113 water utilities examined by this method it was shown that the above six measures were 'relatively highly interrelated,' and were a general price index for these utilities. The results also indicated a strong association between the monthly metered rate for 100,000 cubic feet, and the water revenues per million gallons sold. A further investigation showed that the 25 utilities having the lowest water prices were located near large bodies of water, and the 25 utilities having the highest prices were privately owned. (Hewett-Rutgers)
W71-03222

6D. Water Demand

EXPORT OF MISSISSIPPI RIVER WATER TO TEXAS AND NEW MEXICO,
Bureau of Reclamation, Austin, Tex.
For primary bibliographic entry see Field 06B.
W71-02852

ALFALFA FOR FORAGE PRODUCTION IN ARIZONA,
Arizona Agricultural Experiment Station, Tucson.
For primary bibliographic entry see Field 02G.
W71-02868

THE IMPACT OF DIFFERENT LEVELS OF WATER DEVELOPMENT ON TEXAS AGRICULTURE,
Texas Agricultural Experiment Station, College Station.
For primary bibliographic entry see Field 03F.
W71-02876

FORECASTING WATER DEMANDS AND SYSTEMS CAPABILITIES,
Illinois State Water Survey, Urbana.
Wyndham J. Roberts, Sandor C. Csallany, and Neil G. Towery.
ASCE Proceedings, Journal of the Sanitary Engineering Division, Vol 96, No SA 6, Paper 7745, p 1349-1360, December 1970. 12 p, 5 fig, 3 tab, 10 ref.

Descriptors: *Water demand, *Forecasting, *Water resources development, *Evaluation, *Illinois, Community development, Water supply, Planning, Hydrology, Reservoirs, Rivers, Groundwater, Wells, Sanitary engineering, Data collections.
Identifiers: Inventories, Operations research.

One feature of the 1968 Illinois Water Plan was concerned with the condition and future capability of water systems in 1200 incorporated communities. It was necessary to determine the condition of each water facility, such as its present pumpage, the filter plant capacity, and the water source capacity. Projections of water demands on each system to the year 1980, and a county basis to 2020, were made by using population estimates. By developing a gallons per capita per day relationship from present pumpage and present population data, corresponding 1980 values could be computed by using the appropriate projected population data. The technique for presenting these data is shown in both graphical and formula form. In addition, tables and graphs are included to show various paramater relationships and how the large amount of data were assembled in order to display projections individually, by counties, and by river basins. This water resource planning approach has a potential for wide use beyond the area for which it was developed. (Woodard-USGS)
W71-02905

ARIZONA AGRICULTURE 1969.
Arizona Univ., Tucson. Dept. of Agricultural Economics.
For primary bibliographic entry see Field 03F.
W71-02967

THE DEMAND FOR WATER BASED RECREATION IN SOUTHWEST PUERTO RICO,
Puerto Rico Univ., Mayaguez. Water Resources Research Inst.
Gerald Latortue.
Available from NTIS as PB-196 475, $3.00 in paper copy, $0.95 in microfiche. Water Resource Research Institute Publication, November 1970. 48 p, 2 append. OWRR Project A-015-PR (1).

Descriptors: *Water recreation, *Water demand, Industrial production, Ecology, Environmental effects, Feasibility study, Puento River, Attitudes, Social aspects, Recreation, Recreation facilities.
Identifiers: *Opinion research, Economic growth.

This study conducts a survey of existing water-based recreational areas and facilities in Southwest Puerto Rico to determine whether the water resource facilities are being fully utilized. Two series of personal interviews were conducted to determine the opinions of a sample of the users of these water-based recreational facilities. The results indicate that weekend holiday attendance at beaches is higher; people at water-based recreation facilities prefer swimming to sailing and surfing; the majority of visitors go to beaches year round. The author concludes that he demand for water-based recreational facilities in Southwest Puerto Rico is extremely low with a few exceptions. If the Puerto Rican Government succeeds in the industrial development of the Southwest region, the demand will increase considerably. In that case, the government should improve beach facilities, build better access roads and publicize the location of the more remote water recreation areas. However, government programs in these areas should also try to consider the ecology of the area and the potential environmental damage from wide scale industrial development. (Siegenthaler-Rutgers)
W71-03008

CITY OF PHILADELPHIA V PHILADELPHIA SUBURBAN WATER CO (COMPETING USES OF LIMITED RESOURCES).
For primary bibliographic entry see Field 06E.
W71-03233

6E. Water Law and Institutions

THE IMPACT OF FEDERAL WATER LEGISLATION AT THE STATE AND LOCAL LEVEL,
Central Washington State Coll., Ellensburg. Dept. of Geography.
Kenneth A. Hammond, Daniel P. Beard, and Keith W. Muckleston.
Available from NTIS as PB-196 309, $6.00 in paper copy, $0.95 in microfiche. Completion Report, Washington Water Research Center, Washington State Univ, Pullman, October 1970. 358 p, 25 tab, 14 fig, 269 ref. OWRR Project B-019-WASH (5).

Descriptors: *Recreation, Grants, Administration, *Institutions, *Legislation, Recreation demand, Recreation facilities, Institutional constraints, Political aspects, Political constraints, Water Quality Act, Legal aspects.
Identifiers: *Administrative institutions, Policy development, Intergovernmental impact, Land and Water Conservation Fund Act, Federal Water Project Recreation Act.

The Land and Water Conservation Fund Act and the Water Quality Act of 1965 are landmarks in resource policy. Both have altered the magnitude and emphasis of Federal, State, and local efforts. They will not be adequate but are necessary and desirable responses to changing conditions and social priorities. Though not without merit, the Federal Water Project Recreation Act does not equal the others in importance. State and local governments need the impetus provided by Federal programs of assistance and guidance. States have made significant institutional and financial adjustments to favor programs with long-range benefits which otherwise would languish. However, once the program is safely underway the Federal level should make every effort to withdraw from direct and detailed program supervision. The states should treat local governments with similar consideration. Basic geographical and ecological information is not entering the decision-making process. The finite nature of the earth and the inadequacy of any solution which requires ever greater dedication of resources to any particular use must eventually be recognized. Recreation has now been elevated to the status of a human and social need. The provision of low density activities will become progressively more important and more difficult with expanding human populations and urban agglomerations.
W71-02826

MORROW STEAMSHIP CO V SUPERIOR WATER, LIGHT AND POWER CO (LIABILITY FOR ACCIDENT CAUSED BY CABLE BEING FLOATED ON SURFACE).

31 F2d 486-488 (WD Wis 1928).

Descriptors: *Wisconsin, *Propellers, *Accidents, *Ships, Hazards, Judicial decisions, Legal aspects, Remedies, Admiralty, Damages, Navigation, Navigable waters, Ships, Boats, Channels, Buoys, Floating, Floats, Jurdisdiction, Federal jurisdiction, Competing uses.
Identifiers: *Obstructions to navigation.

Libelant steamship owner filed a libel against respondent for damages suffered when respondent's cable became entangled in the steamship's propeller. The cable had been floated to the surface of a channel to make repairs. Respondent cross-libeled for damage caused to the cable. Libelant contended the admiralty court had no jurisdiction for the cross-libel since it involved an instrument of land commerce. The court held both parties were at fault. The steamship had noticed the barrels floating the cable and should have delayed until the cable was pulled from the channel. Respondent had had a tugboat by the floating cable, but discharged it despite the frequent use of the channel and left only three men in a rowboat to move the cable. The court held that it had jurisdiction to hear the cross-libel since the cable was afloat in navigable waters when the accident occurred. (Morris-Florida)
W71-02838

CITY OF LOS ANGELES V BORAX CONSOL LTD (DETERMINATION OF UPLAND-TIDELAND BOUNDARY).

74 F2d 901-907 (9th Cir 1935).

Descriptors: *California, *Islands, *Boundaries (Property), *Tidal waters, Boundary disputes, High water mark, Meanders, Land tenure, Real property, Patents, Surveys, Reservation doctrine, Legal aspects, Judicial decisions, Adjudication procedure, United States, Administrative agencies, Relative rights.

Plaintiff city brought action against defendant corporation to quiet title to a portion of the shore of an island. Plaintiff claimed title in the tidelands through a grant from the state while defendant claimed title in the island through a patent from the United States. The meander line of the island described in defendant's patent was below the mean high tide mark; defendant claimed title to the meander line, whereas plaintiff asserted title in the tidelands to the mean high tide mark. The court determined that the boundary line of the island was the seashore rather than the patent meander lines. Since title to the tidelands had vested in the state before the United States surveyed the island, and the surveyor had not attempted to determine the tideland-upland boundary, the court held the meander line was not plaintiff's boundary. The court observed that the true boundary was the mean high tide mark, the location of which was a question of fact for a jury. The trial court's judgment was reversed and the case was remanded for determination of the mark. (Hart-Florida)
W71-02839

RYAN V CHICAGO B AND Q RR (CONGRESSIONAL AUTHORIZATION OF DAM CONSTRUCTION).
59 F2d 137-145 (7th Cir 1932).

Descriptors: *United States, *Dam construction, *Dam design, *Condemnation, Legislation, Dams, Appropriation, Judicial decisions, Legal aspects, Flood control, Navigable rivers, Mississippi River, Federal government, Eminent domain, Water rights, Riparian rights, Riparian land, Water resources development.

Plaintiff railroad company owned and operated a railroad along the shore of a river. Congress authorized and appropriated funds for erection of a dam on the river. Defendants, government officers, sought to condemn plaintiff's property for a dam site. Plaintiff instituted an action to enjoin defendants from proceeding with condemnation proceedings and construction of the dam. Plaintiff contended that Congress had specified construction of a movable, navigable type of dam, and defendants were erecting a fixed, non-navigable dam which was unauthorized and would flood plaintiff's property. Defendant contended that Congress had approved the dam construction. Furthermore, defendants contended that the bill should have been dismissed since the United States had not consented to be sued. The court held that defendant was authorized to construct a fixed dam. The court further held that the suit to enjoin the government officers was not a suit against the United States so as to require consent. The court stated that where Congress authorized dam construction, the Secretary of War had wide discretion to determine specific and detailed plans. (Powell-Florida)
W71-02840

LITTLE FALLS FIBRE CO V HENRY FORD AND SON (LIABILITY FOR LOSS OF POWER HEAD UPSTREAM FROM DAM AND HYDROELECTRIC PLANT).
127 Misc 834, 217 NYS 534-542 (1926).

Descriptors: *New York, *Dams, *Head loss, *Natural flow doctrine, Backwater, Hydraulic machinery, Industries, Power head, Riparian rights, Riparian land, Riparian waters, Navigable rivers, United States, Permits, Legislation, Federal Power Act, Legal aspects, Water rights, Eminent domain, Reasonable use, Judicial decisions, Obstruction to flow, Streamflow, Hydroelectric plants, Tailrace, Tailwater, Relative rights.

Plaintiff manufacturers owned certain riparian lands, water rights and water power rights along a navigable river. Defendant manufacturer operated a hydroelectric plant at a federal dam downstream from plaintiffs' property. Plaintiffs sued to enjoin defendant from maintaining flashboards on the dam so as to reduce the available power head for plaintiffs' hydraulic machinery and to recover damages for loss of water power. Plaintiffs contended that their right to the natural flow of the river and their water power rights were property rights which could not be damaged without compensation. Defendant contended that it was acting on behalf of and under license from the United States, that it could not be held liable without the consent of Congress and that its actions were for the benefit of commerce and navigation. The court noted that defendant's license under the Federal Power Act expressly provided that the licensee was responsible for any property damage and that, even if the work benefitted navigation, it would be subject to the fifth amendment prohibition against taking private property for public use without just compensation. The court granted the injunction and referred the case for findings as to damages. (Liptak-Florida)
W71-02844

IN RE CERTAIN LANDS IN CITY OF NEW YORK (CITY'S OWNERSHIP OF BEDS).
127 Misc 710, 217 NYS 544-565 (S Ct 1926).

Descriptors: *New York, *Boundary disputes, *Ownership of beds, *Navigable waters, Streams, Rivers, High water mark, Low water mark, Eminent domain, Cities, Condemnation, Compensation, Public rights, Proprietary power, Channels, Boundaries (Property), Land tenure, Administrative agencies, Legislation, Legal aspects, Judicial decisions, Beds.

The City of New York sought, through eminent domain proceedings, to acquire title to lands on the shore of the Harlem River. Part of the land involved was the bed of a creek to which the City alleged it held title. Claimants also alleged title, relying on a chain of conveyances dating from Dutch colonial authorities. The chain of title included a conveyance of all interest the state of New York held in the creek bed. The City alleged that the state grant was void because at the time of the conveyance the state had no interest to convey; the state had already effectively conveyed the land to a town. The trial court found for claimants. The state is presumed to hold title to lands under water, and the burden of proving otherwise is on the party asserting such. However, the grants through which the City claimed indicated ownership by the town only to the high water mark. On the other hand, claimants' title was supported by the evidence. Claimants further contended that they had acquired title by adverse possession and estoppel. Because of the proprietary use of the land by the City, the court held that these doctrines would apply. The City was estopped to deny claimants' title to the lands. Finally, the City could not attack claimants' title on grounds that the state grant reserved public right of entry. (Duss-Florida)
W71-02856

HYDROLOGICAL AND RELATED DATA PROGRAMS IN THE UNITED STATES OF AMERICA,
Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 07A.
W71-02918

FIFTY ENVIRONMENTAL PROBLEMS OF TIMELY IMPORTANCE,
Rand Corp., Santa Monica, Calif.
For primary bibliographic entry see Field 05B.
W71-02953

BOARD OF HUDSON RIVER REGULATING DIST V FONDA, J AND G RR (CONDEMNATION OF RIGHT-OF-WAY FOR CONSTRUCTION OF RESERVOIR).

127 Misc 866, 217 NYS 781-799 (S Ct 1926).

Descriptors: *New York, *Navigable rivers, *Reservoirs, *Flood control, Dams, Condemnation, Eminent domain, Public health, Railroads, Administrative agencies, Federal jurisdiction, State jurisdiction, Watershed management, Flow control, Right-of-way, Benefits, Water conservation, Damages, Plans, Hudson River, Navigable waters, Judicial decisions, Legal aspects.

Plaintiff river regulating district sought to condemn part of defendant railroad's right-of-way. Plaintiff was acting pursuant to state law which created regulating districts and empowered them to construct reservoirs to regulate the flow of streams when required by the public welfare. Defendant contended that the board had not complied with the prerequisites to condemnation, alleging that plaintiff needed the permission of the interstate Commerce Commission under a federal law which stated that navigable rivers could not be obstructed without Commission consent. Defendant also alleged that the property was not being taken for a public use. The court found for plaintiff. The river on which the dam and reservoir would be constructed was not a navigable river under federal law. As to the Hudson River, the proposed improvements would improve the navigable capacity of the river by controlling the flow during dry and flood conditions. As to the nature of the public use, it was not fatal to the project that private interests would also benefit. Controlling the flow of streams had sufficient benefits for public safety and health to constitute a public use. (Duss-Florida)
W71-02957

PEOPLE EX REL MEXICAN TELEGRAPH CO V NEW YORK STATE TAX COMM'N (STATE MAY TAX FEDERAL LICENSEE'S FRANCHISE).
219 App Div 401, 220 NYS 8-18 (1927).

Descriptors: *New York, *Taxes, *Federal jurisdiction, *State jurisdiction, Federal government, Navigable waters, Ownership of beds, State governments, Legal aspects, Political aspects, Remedies, Judicial decisions, Government finance, Profit, Public lands, Public benefit.

Relator telegraph company sought to review a special franchise tax assessed by defendant state tax commission. Relator contended that it held a federal license and was therefore exempt from state taxation of its franchise. Relator maintained that it had acquired a presidential permit to operate its cables over submerged lands within the three-mile limit off of the coast of New York. Defendant contended that the state, owner of the submerged lands within the three-mile limit, could tax the franchise because the relator was not an agent of the federal government. Defendant maintained that the relator was only a licensee of the federal government and, as such, amenable to a state's special franchise tax. The New York supreme court held that a foreign company was not exempt from a state's special franchise tax because it held a federal license. (Quesada-Florida)
W71-02984

A CRITIQUE OF FEDERAL WATER RESOURCES POLICIES: HYDROELECTRIC POWER VERSUS WILDERNESS WATERWAY ON THE UPPER MISSOURI RIVER,
Cornell Univ., Ithaca, N.Y.
For primary bibliographic entry see Field 06B.
W71-03016

PEOPLE EX REL LEHIGH VALLEY RR V STATE TAX COMM'N (NATURE OF RAILROAD'S RIGHT TO CROSS NAVIGABLE STREAMS).

220 App Div 1, 220 NYS 467-469 (1927).

Descriptors: *New York, *Navigable rivers, *Ownership of beds, *Easements, Navigable waters, Streams, Legal aspects, Judicial decisions, Beds, Taxes, Cities, Dredging, Railroads, Bridges, Construction.

Plaintiff state of New York, on the relation of a railway company, sought to exclude from taxation as special franchise several of the company's bridges across two streams. Relator railroad claimed that the streams were not navigable, that it owned the beds of the streams, and as a result that it was not subject to taxation on its bridges. The trial court found that the railway's bridges were taxable, and the New York supreme court affirmed. The lower court was correct in finding the streams navigable. As such, there existed an easement in the public to use the stream as a highway. Being a public highway, a franchise was necessary to cross. Moreover, relator's alleged ownership of the streambeds could not be determinative of the issue of taxation in any event. Ownership of the bed of a public stream is not ownership of the stream but of a property right subject to the easement in the public. Relator's right to cross these streams did not rest in ownership of the beds but was conferred by its charter of incorporation. Thus, it was a franchise and taxable even if relator did own the streambeds. Relator further contended that the streams were not navigable until dredged and that its bridges were constructed before the dredging. This contention, the court held, was not supported by the evidence. (Duss-Florida)
W71-03019

PEOPLE EX REL GRAND TRUNK RY V GILCHRIST (TAXATION OF RAILROAD COMPANY OPERATING OVER NAVIGABLE STREAM).
221 NYS 613-619 (1927).

Descriptors: *New York, *Navigable rivers, *Taxes, *Bridges, Assessments, Railroads, Engineering structures, Construction, Judicial decisions, Legal aspects, Right-of-way, Leases, Contracts, Governments, State governments, Navigation, Navigable waters.

Under authorization from the state, New York and Canadian corporations erected and owned a two level suspension bridge crossing the Niagara River. Plaintiff railroad company leased the upper deck of the bridge and was obliged to furnish the rails, ties and other track equipment. Defendant state tax commission assessed the railroad company for operation of a special franchise. Plaintiff sought review of the special franchise tax assessment. Plaintiff claimed it derived its right to cross the river on the bridge under its leases from the bridge companies. Defendant contended: (1) that plaintiff's rights came from the state; (2) that plaintiff owned tangible property on the top floor of the bridge; and (3) that use of such property over a navigable stream for railroad purposes constituted a special franchise which was taxable. The court reversed the trial court's judgment for plaintiff. The court held that plaintiff, in operating its railroad over a navigable stream and using its own tangible property on the bridge structure, was liable for taxation of a special franchise. The court also stated that the Niagara River was of navigable character even though at the point of the bridge, because of the proximity of rapids, the river was not navigable in fact. (Powell-Florida)
W71-03022

BOARD OF HUDSON RIVER REGULATING DIST V FONDA, J AND G RR (TAKING OF PROPERTY TO REGULATE RIVER FLOW FOR PUBLIC BENEFIT).
223 App Div 358, 228 NYS 686-701 (1928).

Descriptors: *New York, *Condemnation, *Flood control, *Public benefit, Eminent domain, Railroads, Right-of-way, Navigable waters, Rivers, Judicial decisions, Legal aspects, Reservoirs, Drainage systems, Flow control, Flood protection, Public health, Water management (Applied).
Identifiers: *Constitutions.

Plaintiff river-regulating district was created under a conservation law for the purpose of establishing a reservoir in drainage areas to regulate the flow of a river. Defendant railroad company owned land within the district. Plaintiff condemned defendant's land and defendant appealed the damage awards. Defendant contended that, since 95 per cent of the improvement assessments were paid by private beneficiaries, the primary purpose of the condemnation was a private purpose. Defendant claimed the primary purpose of the reservoir was the creation of power for private use. Defendant asserted that the taking of its property violated the commerce clause of the federal constitution. Plaintiff contended that regulation of river flow was the primary, amd public, purpose of the improvements. The New York supreme court held the condemnation proceedings were primarily for a public purpose, notwithstanding incidental private benefit. The condemnation of defendant railroad's right-of-way for the purpose of flood control was not an unconstitutional interference with interstate commerce. The court reasoned that incidental interference with interstate commerce, resulting from plaintiff's acts in protecting public health and welfare, was not repugnant to the commerce clause. (Powell-Florida)
W71-03026

BAY RIDGE DOCK CO V UNITED DRY DOCKS, INC (GRANTEE OF BOTTOMLAND MAY FILL IN TO BULKHEAD LINE).

146 Misc 404, 262 NYS 212-216 (S Ct 1932).

Descriptors: *New York, *Navigable waters, *Docks, *Ownership of beds, Beds, Channels, Bulkhead lines, Coastal structures, Legal aspects, Judicial decisions, Legislation, Governments, Admiralty, Harbors, Ships, Transportation, Public lands, Navigation.

Plaintiff dock company sought to enjoin defendant dock company from constructing a floating dry dock in the strip of open water between plaintiff's dock and defendant's dock. Although defendant held title to the bottomland upon which the dock was to be constructed, plaintiff maintained that defendant could not obstruct navigation. Plaintiff contended that it depended on the open water to dock vessels bringing cargo into its dock. Defendant contended that it had been granted title to the bottomland by the state and also the right to fill to the bulkhead line. The New York supreme court held that a state may make grants of lands under navigable waters for purposes useful to the public. Ownership of such lands includes the right to construct a pier or dock and to fill such land for the grantee's or the public's use. (Quesada-Florida)
W71-03030

UNITED STATES V WEST VIRGINIA (POWER OF THE UNITED STATES TO PREVENT CONSTRUCTION OF DAMS ON NAVIGABLE RIVERS).
295 US 463, 55 S Ct 789-793 (1935).

Descriptors: *Navigable waters, *Federal jurisdiction, State jurisdiction, *Hydroelectric project licensing, West Virginia, Dams, Federal government, State governments, Judicial decisions,

Legislation, Damsites, Electric power, Beneficial use, Flood control, Legal aspects, Water resources development, Federal Power Act, Projects, Project purposes, Navigation, Permits.

Plaintiff United States sought an injunction against defendant state to prevent the state from granting permission for the construction of a dam on an interstate navigable river. Plaintiff contended that the river was navigable and therefore under the control of Congress. Therefore, no dam which would disrupt navigation or interfere with federal projects could be authorized by defendant without prior Congressional approval. Defendant contended that the authorized dam would not interfere with navigation and that it could authorize such projects as would improve navigation. Noting that Congress had absolute authority over navigable rivers and potential obstructions to navigation, the Supreme Court of the United States nevertheless dismissed the case for lack of a case or controversy within the meaning of its original jurisdiction. Plaintiff had failed to allege actual or threatened interference. (Quesada-Florida)
W71-03041

ST HELEN SHOOTING CLUB V MOGLE (CONVEYANCE OF HUNTING RIGHTS IN LAKE AND LAND SURROUNDING LAKE).
234 Mich 60, 207 NW 915-919 (1926).

Descriptors: *Michigan, *Ownership of beds, *Hunting, *Lakes, Shores, Wildlife, Fishing, Contracts, Easements, Land tenure, Marshes, Public rights, Beds, Leases, Legislation, Judicial decisions, Legal aspects.

Plaintiff sought to restrain defendants from infringing its hunting rights in a lake and in land surrounding the lake. Plaintiff's grantor had conveyed exclusive hunting rights to plaintiff when grantor was owner in fee of all the land bordering the lake. Subsequently, defendant purchased in fee a portion of the land bordering the lake. Subsequently, defendant purchased in fee a portion of the land bordering the lake, subject to the hunting privileges granted plaintiff. The trial court dismissed plaintiff's bill on the ground that the earlier conveyance was void as against public policy. The Michigan Supreme Court reversed. An owner in fee of all land bordering on a lake also owns the land under the lake. An owner in fee of shores and subaqueous lands has exclusive hunting privileges in those lands. Such owner may segregate the rights from the fee and convey them to one having no interest or ownership in fee, and such conveyances are not against public policy. Plaintiff's grantor, being possessed of exclusive hunting privileges, merely exercised a legal right in conveying them to plaintiff. (Duss-Florida)
W71-03049

KAVANAUGH V BAIRD (DISPUTE OVER TITLE TO RELICTION ON LAKE HURON).
241 Mich 240, 217 NW 2-7 (1928).

Descriptors: *Boundary disputes, *Michigan, *Lake Huron, *Accretion (Legal aspects), State governments, Administrative agencies, Land tenure, Real property, Ownership of beds, Lakes, Navigable waters, Meanders, Boundaries (Property), Docks, Easements, Legal aspects, Judicial decisions.

Plaintiff riparian landowner brought action against defendant state commissioner to quiet title to a reliction on Lake Huron. Plaintiff claimed title in fee to the reliction, whereas defendant asserted title in the state in trust for the people. The court observed that a riparian owner has a right of access to the navigable waters extending from the meander line, although the intervening space has become dry through reliction, but this right does not entitle the riparian owner to a fee title in the reliction. The court furthermore noted that plaintiff had the indefeasible right to wharf out to the navigable waters. Determining that changes in the lakeshore by accretion and reliction do not affect the rights of riparian owners or the state, and that title to the lake bed was in the state when it was admitted to the Union, the court held title in defendant. The court rejected plaintiff's assertion that this holding violated the fourteenth amendment. (Hart-Florida)
W71-03050

SOO SAND AND GRAVEL CO V M SULLIVAN DREDGING CO (RIPARIAN OWNERS HAVE SOLE RIGHT UNDER STATUTE TO LEASE LAKE BED).
259 Mich 489, 244 NW 138-141 (1932).

Descriptors: *Michigan, *Leases, *Lake beds, *Riparian rights, Riparian land, Legal aspects, Judicial decisions, Damages, State governments, Administrative agencies, Legislation, Riparian waters, Lake Superior, Lakes, Public rights, Ownership of beds, Shores, Gravels, Mining, Dredging.

Plaintiff gravel company sued defendant dredging company for the value of gravel defendant had removed from the bed of Lake Superior in an area extending up to one mile from the shore of plaintiff's property. Defendant contended it had a valid lease from the state Department of Conservation. The Supreme Court of Michigan, in reversing a decision for defendant, held that the statute allowing the leasing of the lake bed up to one mile from shore or to the low water mark for mining purposes was limited exclusively to leasing to the riparian owner. The statute did not merely give him a preference over other lessees. If the owner did not choose to lease, neither he nor anyone else could take gravel or other material from the lake bed. The court found the statute was enacted to protect the riparian owners. Although the state holds title to lake beds in trust for the people, for purposes other than the trust, the state's right to use the beds is subordinate to that of the riparian owner. (Morris-Florida)
W71-03052

PEOPLE EX REL WESTERN, N Y AND PA RY V STATE TAX COMMISSION (STATUTE DECLARING RIVER NAVIGABLE DOES NOT LIMIT RIGHTS OF RIPARIAN OWNERS).
244 NY 596, 155 NE 911-912 (1927).

Descriptors: *Taxes, *New York, *Non-navigable waters, *Riparian rights, Judicial decisions, Legal aspects, Remedies, Legislation, Navigable rivers, Riparian land, Canals, Ownership of beds, Bridges, Railroads, Administrative agencies, Shores, Eminent domain.

Plaintiff railroad company sued defendant state tax commission to vacate three special franchise assessments based on plaintiff's erection of bridges across a river. Plaintiff contended the river was not navigable and that the shores and bed were privately owned. Thus, the right to erect the bridges did not constitute a special franchise. The state claimed the river was declared navigable by a state statute. The Court of Appeals of New York, in affirming a decision for plaintiff, held that the river, in the area between the bridges, was not navigable for any purpose. The statute purporting to declare it navigable was enacted after the state had parted with title to the shores and bed of the river. The state could not without compensation destroy the property rights of the riparian owners who had received the grants of title. Moreover, state acquisition of strips of the shore at a canal crossing could not make it a public navigable stream when it wasn't, in fact, navigable. (Morris-Florida)
W71-03059

PEOPLE EX REL LEHIGH VALLEY RY V STATE TAX COMM'N (STATE MAY ASSESS FRANCHISE OF BRIDGE OVER NAVIGABLE WATERS REGARDLESS OF WHETHER BED IS PRIVATELY OWNED).
247 NY 9, 159 NE 703-707 (1928).

Descriptors: *New York, *Bridges, *Navigable rivers, *Taxes, Railroads, Legal aspects, Judicial decisions, State governments, Federal governments, Ownership of beds, Shores, Streams, Boats, Legislation, Public rights, Administrative agencies, Navigation, Transportation, State jurisdiction.

Appellant railroad company sought to set aside an assessment on special franchises by respondent state tax commission. The assessment was for two bridges appellant had constructed over a river whose shores and bed it owned, but which was alleged to be navigable. Appellant asserted that since the bridge was constructed over its private property, it did not constitute a special franchise unless it actually interfered with public use of the stream. The Court of Appeals of New York, in affirming a judgment for respondent, held that the bridge was a special franchise even though it did not presently interfere with the small craft which used the river. The government's power to regulate rivers comes not from ownership but from its duty to maintain the avenues of commerce. A bridge is such a potential interference that Congress, or in its absence, the state, may regulate it. The perils caused by a bridge include not only obstruction to ships but the danger of items falling on craft below it. Even though the bridge here was constructed without governmental objection, the state may still assert its dominion. (Morris-Florida)
W71-03063

TEXAS AND PAC-MO PAC TERMINAL RR V W G COYLE AND CO (CONDEMNATION OF RIVERFRONT BATTURE).
159 La 1079, 106 So 571-574 (1925).

Descriptors: *Louisiana, *Eminent domain, *Condemnation, *Riparian land, Condemnation value, Local governments, Legislation, Land, Real property, Beds, Beds under water, Ownership of beds, Legal aspects, Judicial decisions, Adjudication procedure, Railroads, Mississippi River, Rivers, Banks, Shores, High water mark, Land tenure, Public rights.

Plaintiff railroad sought to expropriate land of defendant lying between a levee and the Mississippi River, sometimes submerged in high water, for the purpose of constructing an incline for passage of its cars onto a ferry. Defendant contended that: (1) article 14 of the Louisiana constitution limited expropriation of riverfront property to improvements thereon, and then only by order of the port authority; (2) plaintiff could not obtain complete title to the property; and (3) some of the property was in the bed of the river and not subject to private ownership. The Supreme Court of Louisiana affirmed a judgment for plaintiff. The provisions of article 14 did not deal with the power of eminent domain in general, but merely with the authority of the governing authority of the riverfront and did not limit the general power of condemnation. The court stated that the fact that plaintiff might not gain complete title, as riverfront owners are subject to regulation by the port authority, was not defendant's concern. If the property was not subject to private ownership, plaintiff would be paying something for nothing, but this too was not defendant's concern. Finally, the court stated that batture land, even if submerged during high water, is a continuation of the soil of the shore and belongs to the riparian owner. (Dye-Florida)
W71-03065

ELLERBE V GRACE (CONVEYANCE BY STATE OF DRY BEDS FORMERLY UNDER NAVIGABLE WATERS).
162 La 846, 111 So 185-187 (1926).

Descriptors: *Louisiana, *Dry beds, *Ownership of beds, *Land tenure, Beds under water, Lakes, Land, Real property, Legislation, State governments, Federal government, Legal aspects, Judicial decisions, Adjudication procedure, Lake beds, Navigable waters, Swamps, Public lands.

Plaintiffs sought to enjoin defendant register of the state land office from disposing of lands claimed by plaintiffs under conveyances from a state levee board. The land was once beneath the surface of a navigable lake, since dried up. The Supreme Court of Louisiana held for plaintiffs. Lands under navigable waters belong to the state. When navigable lakes dry up, the uncovered beds remain the property of the state. Act Number 74 of 1892 had granted plaintiffs' predecessor in title, the levee board, all state lands, however acquired, within the county. The levee board had conveyed the lands to plaintiffs' predecessor, and they to plaintiffs. State officers were estopped from asserting title to land conveyed by statute to the levee board, as against grantees from the board. (Dye-Florida)
W71-03066

NEW ORLEANS LAND CO V BOARD OF LEVEE COMM'RS OF ORLEANS LEVEE DIST (PROFIT FROM CONDEMNATION PROCEEDINGS).
171 La 718, 132 So 121-124 (1930).

Descriptors: *Louisiana, *Condemnation, *Condemnation value, *Public benefits, Legal aspects, Right-of-way, *Compensation, Judicial decisions, Adjudication procedure, Land, Real property, Lakes, Erosion, Beds, Lake beds, Navigable waters, Beds under water, Levees, Landfills, Land reclamation, Land development, Eminent domain.

Several years before the institution of the instant action, defendant levee district had obtained a right-of-way from plaintiff's predecessor in title for the purpose of constructing a levee. After construction of the levee, plaintiff's property abutting Lake Pontchartrain and outside the levee was eroded, much of it becoming lake bottom. The land in dispute in the instant case included land under water and what remained of the shore. Defendant levee district sought to take this land and reclaim it for residential purposes. Plaintiff contended that: (1) it was entitled to compensation for all the original land, including that under water; and (2) defendant was not constitutionally authorized to condemn land which it later intended to sell for pecuniary gain. The Supreme Court of Louisiana affirmed a judgment condemning the land and compensating plaintiff only for land above the high water mark. Bottoms of navigable waters are owned by the state to the high water mark. Defendant's purpose was the public benefit. The fact that some profit might accrue to the levee board did not invalidate the condemnation. (Dye-Florida)
W71-03068

PIZANIE V GAUTHREAUX (MEANING OF 'RIVER BANKS' IN DETERMINING EXTENT OF PUBLIC USE).
173 La 737, 138 So 650-652 (1931).

Descriptors: *Louisiana, *Banks, *Access routes, *Public rights, Navigable rivers, High water mark, Low water mark, Riparian land, Riparian rights, Riparian waters, Rivers, Navigable waters, Land tenure, Judicial decisions, Legislation, Legal aspects, Relative rights.

Plaintiff sought to enjoin defendant from trespassing upon a strip of plaintiff's property between a public road and the banks of a navigable river. Defendant contended that by statute the banks of navigable rivers were preserved for the use of the public, even though ownership was in a riparian owner. Defendant, in using the strip as an access route to a wharf, contended that as a member of the public he was making legitimate use of the bank. The court held that 'river bank', as used in the statute, meant the lands lying between the high water mark and low water mark of a river. So interpreted, the court held that the strip of land involved was not part at the bank of the river. Defendant was thus enjointed from trespassing upon the strip of land. (Snow-Florida)
W71-03073

FEDERAL PUBLIC LAND LAWS AND POLICIES RELATING TO INTENSIVE AGRICULTURE. VOLUME I. LEGAL STUDY.
Public Land Law Review Commission, Washington, D.C.

Available from NTIS as PB-188 061, $3.00 in paper copy, $0.95 in microfiche. October 1969, various pagings.
Identifiers: *Agriculture, *Economics, *Water supplies, *Law, Money, Labor, Classification, Identification, Minerals, Irrigation systems, Patents, Control, Standards, Deserts, Reclamation, Budgets, Soils, Forestry, Feasibility studies, Management planning, Homestead Acts.

Review and analysis of the existing system of laws and policies for the disposal of agricultural lands for intensive agricultural purposes. The homesteading of public lands under the General Homestead Laws, Special Homestead Laws, The Desert Land Act. The Indian Homestead and Allotment Laws, Acreage limitation policies. The classification laws and their effect on disposal of land for agricultural use. Agricultural use of federal land by lease or permit and a comparative review of laws governing the disposal or lease of agricultural lands by various states (Agricultural use of land under the Administrative Jurisdiction of various Federal Agencies by lease or permit. A comparative Review of Laws providing for the disposal or lease of agricultural lands by various States). Problems and alternatives. (See also W71-03079)
W71-03078

REGIONAL AND LOCAL LAND USE PLANNING VOLUME IV.
Public Land Law Review Commission, Washington, D.C.
For primary bibliographic entry see Field 06B.
W71-03079

TOWN OF NAPOLEONVILLE V BOUDREAUX (RIPARIAN OWNER PRECLUDED FROM BUILDING ON BANK OF NAVIGABLE STREAM).

142 So 874-876 (Ct App La 1932).

Descriptors: *Louisiana, *Streams, *Boundaries (Property), *Banks, Navigable waters, Riparian land, Riparian waters, Riparian rights, Boundary disputes, Land tenure, Legal aspects, Judicial decisions, Public lands, Local governments, Public rights, Real property, Buildings, Beds, Ownership of beds, Bayous, Roads, Cities, Accretion (Legal aspects).

Plaintiff town sued to enjoin defendant property owner from erecting a building on the bank of a navigable stream. Defendant's property and the stream were separated by a public street. Plaintiff contended that the bank was public property and that defendant was a mere squatter. Defendant contented that his deed conveyed title not only up to the street but also whatever title his grantor had to the batture land on the bank. Affirming a judgment for plaintiff, the court noted that, although the originators in title did own the bank, defendant's grantor did not receive the bank from his grantor and therefore had nothing to convey to defendant. The court also noted that, even if defendant did own the bank, the bank of a navigable stream is part of the public domain, and a riparian owner cannot appropriate it to private use by constructing buildings thereon. (Liptak-Florida)
W71-03094

SEIBERT V CONSERVATION COMM'N (LOCATION OF LOW WATER MARK AS DETERMINING BOUNDARY BETWEEN BATTURE AND RIVER BED).
181 La 237, 159 So 373-377 (1935).

Descriptors: *Louisiana, *Accretion (Legal aspects), *Low water mark, *Boundaries (Property), Riparian rights, Riparian land, Riparian waters, Ownership of beds, Beds, Banks, Mississippi River, Navigable rivers, River beds, Streams, Boundary disputes, Legal aspects, Judicial decisions, Land tenure, Real property, High water mark, Levees, Administrative agencies, State governments, Remedies, Leases, Gravels.

Plaintiff riparian owner sued defendant state conservation commission to quiet title to property fronting the Mississippi River, to enjoin defendant and its lessee, a gravel company, from trespassing on the property, and to recover rent collected by defendant. Plaintiff contended that the property was batture or accretion to his property, the low water mark being determined according to the state river commission by the average of the lowest annual water for 43 years. Defendant contended that the suit could not be maintained, since it was against the state, and that the property was not batture but a part of the river bed, the low water mark being determined according to the state board of engineers by the average of the lowest daily low water for 43 years. Affirming a judgment for plaintiff, the court noted that defendant was an independant political corporation and could sue or be sued on its own behalf. Without deciding which method of locating the low water mark was correct, the court relied on lay testimony establishing that the sand and gravel was taken from land which was out of the water during the entire low water season. The property was batture land and part of the bank rather than part of the river bed. (Liptak-Florida)
W71-03110

CHINN V PETTY (NO PRIVATE RIGHT TO CONSTRUCT BUILDING ON BANK OF NAVIGABLE STREAM).
163 So 735-736 (Ct App La 1935).

Descriptors: *Louisiana, *Navigable waters, *Buildings, *Banks, Streams, Boundaries (Property), Bayous, Beds, Accretion (Legal aspects), Riparian land, Riparian waters, Riparian rights, Boundary disputes, Land tenure, Legal aspects, Judicial decisions, Public land, Public rights, Real property, Relative rights.

Plaintiff owned a house which he had built on the bank of a navigable stream with the permission of the bank's owner, defendant's predecessor in title. Defendant evicted plaintiff and removed plaintiff's furnishings, whereupon plaintiff brought action against defendant to recover damages for loss of use of the premises, humiliation, value of the house, and damages to the furnishings. Plaintiff contended that although the banks of navigable streams are reserved to the use of the public, ownership is in the adjacent landowner, who in this case granted plaintiff permission to build the house. Affirming a judgment for defendant, the court held that plaintiff was a mere licensee and that none of his rights had been invaded. The court noted that the use of the bank was open to plaintiff as a member of the public, but he could not appropriate it to private use by the construction of a permanent building. (Liptak-Florida)
W71-03129

GREISINGER V KLINHART (PRESCRIPTIVE RIGHT TO MAINTAIN WATER LEVEL IN ARTIFICIAL LAKE FOR FISHING CAMP).
282 SW 473-478 (Mo 1926).

Descriptors: *Missouri, *Lakes, *Recreation facilities, *Prescriptive rights, Dams, Streams, Reservoirs, Reservoir operation, Non-navigable waters, Public rights, Camp sites, Boating, Fishing, Swimming, Legal aspects, Boundaries (Property), Judicial decisions, Navigation, Riparian rights, Water levels.

Plaintiff owned a fishing camp on a lake formed by defendant's dam across a non-navigable stream flowing through plaintiff's and defendant's property. Plaintiff sued to restrain defendant from lowering the water level in the lake and from maintaining a fence across the lake on the property line,

thereby injuring plaintiff's business. Plaintiff contended that he had a prescriptive right to the maintenance of the water level in the lake and that the lake had been dedicated to the public since it had formerly been open to the public without charge and had been stocked with fish by the state. Reversing a judgment for plaintiff, the court first held that the stream was non-navigable, since it was not susceptible to use for commerce in its ordinary condition. The court then found that plaintiff had no prescriptive rights in the lake since he had not exercised any rights for 10 years, could not count the time the property was owned by the common grantor, and his use was not an adverse use. Finally, the court held that there could be no implied dedication of the lake without a showing of a clear intent on the part of the owner to dedicate the lake to the public. (Liptak-Florida)
W71-03187

FINANCING WATER SUPPLY AND SEWERAGE PROJECTS IN DEVELOPING COUNTRIES.
International Bank for Reconstruction and Development, Washington, D.C.
For primary bibliographic entry see Field 06C.
W71-03218

DUMM V COLE COUNTY (TITLE TO ACCRETIONS IN NAVIGABLE RIVER).

287 SW 445-450 (Mo 1926).

Descriptors: *Missouri, *Accretion (Legal aspects), *Boundaries (Property), *Navigable rivers, Missouri River, Rivers, Islands, Real property, Boundary disputes, Land tenure, Low water mark, Surveys, Mapping, Legal aspects, Judicial decisions, Riparian land, Remedies, Adjudication procedure, Local governments, Sand bars, Dikes, Flood protection.

Plaintiff riparian owner brought action against defendant county to quiet title to certain property on a navigable river and to enjoin defendant from selling the property pending determination of ownership. Plaintiff contended that the land was formed by accretions to his land and was therefore his property. Defendant contended that the land was not an accretion to plaintiff's land, but rather was formed as an island in the river and gradually extended to plaintiff's land. Therefore, the land belonged to the county. Defendant also argued that plaintiff's land was agri limitati, strictly limited to the metes and bounds described in the conveyance, and was not entitled to rights of accretion. The court held that the evidence sufficiently supported the lower court's judgment for plaintiff and affirmed the judgment. The court also noted that plaintiff's land was not agri limitati since the survey of the land was to the low water mark even though it was described by metes and bounds. (Liptak-Florida)
W71-03225

DAMS AND SPILLWAYS (PROCEDURES FOR INITIATING CONSTRUCTION OR ALTERATION).
Iowa Code Ann, secs 112.1-112.10 (1949) as amended (Supp 1970).

Descriptors: *Iowa, *Dams, *Spillways, *Administrative agencies, Streams, Lakes, Civil engineering, Costs, Damages, Compensation, Public benefits, Water levels, Riparian land, Judicial decisions, Decision making, Administration, Legislation.

Whenever the state conservation commission believes that it is necessary to erect a dam or spillway, or alter an existing dam or spillway, the commission must adopt a resolution of necessity, describing generally the contemplated work. Subsequently, a competent civil engineer shall prepare a detailed plan showing: (1) work contemplated, (2) effect upon water level, and (3) probable cost. The commission may tentatively approve this plan. Claims for damages by the proposed project shall be filed with the commission prior to a hearing to be held with notice. The plan may be adopted at the hearing or may be modified if adverse effects to riparian owners are not worsened thereby. Damages will be appraised by three disinterested appraisers. At hearing, the commission shall determine the amount due each claimant. The appraiser's report may be followed in the commission's discretion. (Hart-Florida)
W71-03227

EX PARTE KELLER (BOUNDARY DISPUTE OVER SWAMPLAND).
199 SE 909-917 (SC 1938).

Descriptors: *South Carolina, *Boundary disputes, *Swamps, *Boundaries (Property), Land tenure, Real property, Non-navigable waters, Judicial decisions, Legal aspects, Streams.

Plaintiff landowner sued defendant landowner to obtain possession of land. Plaintiff purchased land which had been previously owned by defendant and his deceased brother as tenants-in-common. The land bordered upon a swamp. Defendant purchased land on the other side of the same swamp; this tract had also been previously owned by defendant and his brother. A creek, the common boundary of the two tracts, passed through the swamp. When defendant and his brother had owned both tracts, a highway was constructed through the swamp, altering the creek's course. Defendant had acquiesced in this alteration. Defendant claimed title to the old creek thread, while plaintiff claimed title to the new creek. The court stated that absent an expressed contrary intention, title to land on a swamp runs to the swamp's creek's thread. The Supreme Court of South Carolina stated that where one person owns two tracts and changes the common boundary, a later conveyance of one will be presumed to be to the boundary existing at the time of the conveyance. The court held for plaintiff. Defendant was presumed by his acquiescence to have intended to alter the boundary. (Hart-Florida)
W71-03228

CURRY V CRULL (OWNERSHIP OF ACCRETED ISLAND IN MISSOURI RIVER).
116 SW2d 125-128 (Mo 1938).

Descriptors: *Missouri, *Islands, *Land tenure, *Accretion (Legal aspects), Boundaries (Property), Real property, Missouri River, Navigable rivers, Navigable waters, River flow, Judicial decisions, Legal aspects.

Plaintiff riparian landowner sued to quiet title and to eject defendant interlopers from an island in the Missouri River. Defendants contended that the disputed land formed as an island, whereas plaintiff asserted that the land had originally accreted to his land and that later the River had cut the disputed land off to form an island. Reviewing the evidence, the court held that it supported the lower court's decision for plaintiff. Plaintiff held title in the island by accretion. (Hart-Florida)
W71-03229

SCHLICHTRULL V MELLON-POLLOCK OIL CO (NEGLIGENT DRILLING OF OIL WELL ALLEGED TO HAVE CAUSED SALINE WATER INTRUSION).
301 Pa 553, 152 A 829-831 (1930).

Descriptors: *Pennsylvania, *Saline water intrusion, *Oil wells, *Water wells, Groundwater, Saline water-fresh water interfaces, Mixing, Penetration, Drill holes, Groundwater movement, Damages, Legal aspects, Compensation, Brines, Water supply, Boundaries (Surfaces), Well casings, Saline water, Wells, Seepage, Damages, Remedies.

Plaintiff farmowner sued defendant oil well lessee for damages caused by pollution of plaintiff's well. Defendant had encountered salt water in drilling, and because defendant had failed to drive casings to prevent intrusion of the salt water into the fresh water strata lying above, the salt water seeped into plaintiff's well. The court noted that without negligence no liability inures for interference with subterranean waters. However, defendant was liable because it had failed to exercise due care. Defendant asserted that the oil well was to be abandoned in six months and that, therefore, the injury was temporary. Plaintiff asserted that the injury was permanent, since defendant had not proven that plugging the well would prevent salt water intrusion or restore the property to its original condition. Holding that the injury was permanent, the court affirmed the trial court's measure of damages based upon the diminution in market value of plaintiff's tract. (Hart-Florida)
W71-03230

NATHANSON V WAGNER (ALTERED FLOW OF SURFACE RUNOFF ALLEGED TO HAVE DAMAGED DOWNHILL LANDOWNER).
179 A 466-470 (Ch NJ 1935).

Descriptors: *New Jersey, *Repulsion (Legal aspects), *Surface runoff, *Alteration of flow, Riddance (Legal aspects), Surface waters, Diversion, Relative rights, Drainage water, Legal aspects, Judicial decisions, Overflow, Damages, Slopes, Obstruction to flow, Flood damage, Structures, Barriers, Surface drainage, Buildings.

Plaintiff landowner sought damages and an injunction to prevent defendant contiguous landowner from discharging surface water into his building. The rear of defendant's lot was covered by concrete and cinders and sloped towards plaintiff's lot. Plaintiff alleged that surface water falling upon defendant's building flowed to the rear of defendant's lot, accumulating there with other water to flow into plaintiff's basement, injuring the building foundation. The court defined surface waters as those falling by precipitation or rising from springs. Such waters follow no defined course on land and are lost by diffusion. Stating the common enemy rule that, even though injury ensues, any owner may repulse surface water by any means without liability. The court also noted an exception. A landowner cannot, to his neighbor's injury, artificially alter the natural flow of surface water by accumulating it in artificial channels and augmented quantities. However, because water also flowed onto plaintiff's land from other sources, the court determined that the flooding was not caused by such a wrongful accumulation on defendant's property. Defendant was not liable. (Hart-Florida)
W71-03231

DYKSTRA V DARLING (DRAINAGE RIGHTS OF ADJACENT PROPERTY OWNERS).
150 A 78-79 (RI 1930).

Descriptors: *Rhode Island, *Obstruction to flow, *Natural flow, Drainage, Natural flow doctrine, Ditches, Dams Damages, Dikes, Outlets, Drainage water, Overflow, Channel improvement, Judicial decisions, Legal aspects, Surface waters, Relative rights.

Plaintiff landowner sought to restrain defendant contiguous landowner from maintaining a dam obstructing the natural drainage from plaintiff's tract. A pond on plaintiff's land drained in two directions, flowing in one ditch across plaintiff's land. Defendant contended that this ditch had been dug by his predecessor in title and that therefore he had a right to dam it. Plaintiff asserted that it was a natural watercourse. Defendant further asserted that the pond drained primarily through the other outlet, only draining through the disputed watercourse at extremely high water. The lower court found that the pond drained primarily through the disputed watercourse and that this watercourse was natural, even though it had been cleared and enlarged by defendant's predecessor. However, the appellate court observed that defendant's

predecessor had left a small section of the ditch in its natural state. This section had been dug out by plaintiff so that plaintiff was obtaining drainage in excess of natural drainage. Accordingly, the injunction granted by the lower court was modified to provide plaintiff with only natural drainage. (Hart-Florida)
W71-03232

CITY OF PHILADELPHIA V PHILADELPHIA SUBURBAN WATER CO (COMPETING USES OF LIMITED RESOURCES).
309 Pa 130, 163 A 297-303 (1932).

Descriptors: *Pennsylvania, *Consumptive use, *Preferences (Water rights), *Condemnation, Cities, Water resources development, City planning, Urbanization, Legislation, Competing uses, Equitable apportionment, Local governments, Prior appropriation, Water allocation (Policy), Measurement, Water supply, Water utilization.

Plaintiff city sought to enjoin defendant water company from condemning water in a tributary of the river from which plaintiff obtained its water. Defendant sought to condemn 10 million gallons/day. Plaintiff's requirements were 200 million gallons/day. Plaintiff obtained its right to consume water by legislation before defendant obtained condemnation authority. The court noted that since a navigable river is held for public benefit, it is public property and not subject to eminent domain, although the sovereign may grant rights in a navigable river not interfering with navigation. Plaintiff's grant was found to authorize the taking of a reasonable amount of water. Since defendant's claim was junior to plaintiff's, defendant was enjoined from taking water which would prevent plaintiff from obtaining sufficient water to meet its requirements. Although defendant contended that plaintiff wasted water by failure to meter and by opening hydrants in the summer, since plaintiff was converting to a metered system, the court determined that these practices were not wasteful. The court noted that even plaintiff's right of consumption was subject to the public's navigation rights. (Hart-Florida)
W71-03233

BOYCE COTTONSEED OIL MFG CO V BOARD OF COMM'RS (CONDEMNATION VALUE OF LAND AND MILL TAKEN FOR LEVEE).
107 So 506-511 (La 1926).

Descriptors: *Louisiana, *Levees, *Riparian land, *Condemnation value, Riparian rights, Banks, Public rights, Eminent domain, Condemnation, Compensation, Damages, Mills, Assessments, Taxes, Local governments, Legislation, Flood protection, Legal aspects, Judicial decisions.
Identifiers: Levee districts.

Plaintiff mill owner sued defendant levee district to recover the condemnation value of land and a mill located on the bank of a river. Defendant had built a levee which left plaintiff's property between the levee and the river. Plaintiff contended that, under applicable statutes, the land and mill should be considered taken or destroyed for levee purposes and that plaintiff was entitled to compensation for the full value of the land and mill. Defendant contended that plaintiff had sold the mill for its full value and therefore had suffered no injury, that the value of the mill was limited to the assessed rather than the actual value, and that plaintiff's land was batture land or public bank and could be taken without compensation. The Supreme Court of Louisiana found that plaintiff's land was not batture land since it was not submerged at ordinary high water and was not public bank since it was outside municipal limits. The court affirmed that part of a lower judgment compensating plaintiff for the land but reversed an award of damages for the mill. The court held that the value of the mill was limited to the assessed value, and plaintiff had received more than that amount from the sale of the mill. Three judges dissented on the ground that the assessed value merely limited the amount of compensation, not the value of the property. (Liptak-Florida)
W71-03234

CITIZEN'S HARDWARE AND FURNITURE CO V CHICAGO, ROCK ISLAND AND PACIFIC RY (PROXIMATE CAUSE OF FLOODING MUST BE PROVEN BY PLAINTIFF).

125 So 299-300 (La 1929).

Descriptors: *Louisiana, *Surface drainage, *Culverts, *Flooding, Flood damage, Legal aspects, Judicial decisions, Damages, Local governments, Railroads, Embankments, Surface water, Drainage, Natural flow, Surface runoff, Remedies, Adjudication procedure.

Plaintiff store owner sued defendant railroad company for damages suffered in the flooding of his store. Plaintiff alleged that the flooding was caused by defendant's negligent construction of culverts under a roadbed of defendant. Defendant denied the roadbed or culverts caused the flooding. The Court of Appeal of Louisiana, in affirming a decision for defendant, held that plaintiff had not met the burden of showing defendant's actions were the cause of his damage. Indeed, the evidence showed that plaintiff's building was below the level of the surrounding land and that water naturally gravitated toward it. Other evidence showed that any of several things, including the closing of a culvert by a town, could have caused the flooding . There was no proof that defendant's actions or failure to act caused the damage. (Morris-Florida)
W71-03235

PACIFIC SPRUCE CORP V CITY AND COUNTY OF SAN FRANCISCO (MUNICIPALITY'S LIABILITY FOR SHIP COLLISION WITH BRIDGE).
72 F2d 712-714 (9th Cir 1934).

Descriptors: *Bridges, *Cities, *Ships, *Admiralty, Accidents, Damages, Hazards, Abutments, Piles (Foundations), Permits, Administrative agencies, Judicial decisions, Legal aspects, Adjudication procedure, Damages, Remedies.

Plaintiff corporation brought libel against defendant city for injury sustained by plaintiff's vessel while passing through defendant's bridge. The vessel was being towed backwards through the drawbridge, and by plaintiff's inadvertence the tug required to keep the vessel's bow straight was not secured. When the vessel passed through the drawbridge, the bow swung and the vessel's mast struck the drawbridge overhang. Defendant had previously removed a dolphin which would have prevented the vessel from swinging far enough to strike the overhang. Plaintiff contended that defendant had negligently removed the dolphin and that the bridge was a navigational obstruction not authorized by the Secretary of War. Defendant asserted that plaintiff's negligence was the cause of the injury and, therefore, that it was not liable. The court held that the cause of the accident was the master's negligence in failing to control the bow. Moreover, plaintiff had not proven that defendant's acts so materially contributed to the collision as to require an apportionment of the damages. Defendant's failure to obtain a permit from the Secretary of War was immaterial. (Hart-Florida)
W71-03236

NEBRASKA V WYOMING (EQUITABLE APPORTIONMENT OF WATER RIGHTS IN INTERSTATE RIVER).
295 US 40, 55 S Ct 568-570 (1935).

Descriptors: *Equitable apportionment, *Interstate rivers, *Prior appropriation, *Preferences (Water rights), Nebraska, Wyoming, United States, Nonnavigable waters, Appropriation, Water rights, Legal aspects, Judicial decisions, Diversion, Diversion structures, Dams, Federal government, Federal reclamation law, State governments, Water allocation (Policy).

Plaintiff Nebraska sued defendant Wyoming to ascertain and enforce an apportionment of the waters of an interstate non-navigable river. Plaintiff contended that defendant's citizens had diverted water in excess of their rights of appropriation, that plaintiff's citizens' rights were prior in time, and that the United States had built a dam which also diverted water to plaintiff's injury. Defendant moved to dismiss and contended that plaintiff had failed to join as indispensable parties Colorado, through which the river flowed, and the Secretary of the Interior, who was in charge of the federal dam project. The Supreme Court noted that the missing parties were not indispensable since no claim was made against Colorado, and the Secretary of the Interior was bound by any decision as any other appropriator in Wyoming. The court denied the motion to dismiss. (Liptak-Florida)
W71-03237

BORAX CONSOL V CITY OF LOS ANGELES (FEDERAL VERSUS STATE TITLE TO SUBMERGED TIDAL LAND AND SHORELINE).
296 US, 10 56 S Ct 23-31 (1935).

Descriptors: *United States, *Ownership of beds, *Tidal waters, *Coasts, California, Cities, Oceans, Pacific Ocean, High water mark, Low water mark, Land tenure, Legal aspects, State governments, Judicial decisions, Surveys, Mapping, Administrative decisions, Beds, Shores, Tides.

Plaintiff city sued defendant corporation to quiet title to property bounded by the Pacific Ocean. Plaintiff contended that the property was tideland, which passed to the state on its admission to the Union. Defendant, relying on a government survey and plat, contended that the property was upland and claimed title under a patent from the United States. The Supreme Court noted that the findings of the government surveyor and land office were not conclusive and that the proper boundaries should be determined by the courts after examining all the evidence. Affirming the decree in favor of plaintiff, the court noted that the proper boundary between the tideland, which belonged to the state, and the upland, which was public land and could be granted by the United States, was the mean high water mark determined at mean high tide over a period of years. (Liptak-Florida)
W71-03238

DUCK ISLAND HUNTING AND FISHING CLUB V EDWARD GILLEN DOCK, DREDGE AND CONST CO (FEDERAL AND STATE APPROVAL OF RIVER PROJECTS AS PREREQUISITE TO A VALID CONTRACT).
330 Ill 121, 161 NE 300-305 (1928).

Descriptors: *Illinois, *Rivers and Harbors Act, *Levees, *Contracts, Drainage districts, Judicial decisions, Remedies, Legal aspects, Legislation, Federal government, State governments, Administrative agencies, Navigable rivers, Streams, Navigable waters, Permits, Drainage, Channels, Natural flow, Construction, Drainage effects, Obstruction to flow, Alteration of flow, Dredging.

Plaintiff landowners sought dissolution of a drainage district which had contracted with defendant to construct a levee on the Illinois River. After the contract was signed, the district had modified its plans to get approval from the Secretary of War and the state department of public works. Plaintiffs petitioned for dissolution of the district, alleging that its benefits were not commensurate with the expense and asserting that defendant's contract was void in that it had been signed before the state and federal approval of the plans. Defendants contended that if the river was a stream within the meaning of the state statute and the Rivers and Harbors Act, approval was needed only before the work was begun, not before the contract was

signed. The Supreme Court of Illinois, in affirming a decision for plaintiff, stated that the river was a navigable stream, that the work would narrow the river and increase its flow, and that permits were needed from both the state and federal governments. The court further held that the laws required the granting of the permits before consumating the contract. The contract as executed was void. (Morris-Florida)
W71-03239

CHICAGO, ST L AND N O RR V BULLOCK (LIABILITY FOR FLOOD DAMAGE CAUSED BY OVERFLOW OF DRAINAGE DITCH OBSTRUCTED BY RAILROAD EMBANKMENT).
222 Ky 10, 299 SW 1085-1089 (1927).

Descriptors: *Kentucky, *Ditches, *Obstruction to flow, *Flood damage, Surface drainage, Drainage water, Surface waters, Surface runoff, Damages, Railroads, Embankments, Culverts, Cloudbursts, Rain water, Legal aspects, Judicial decisions, Adjudication procedure, Historic flood, Flooding.

Plaintiff farmer sued defendant railroad to recover for flood damage to his crops. The damage was caused by the obstruction and overflow of a drainage ditch. Plaintiff contended that defendant's embankment had filled in and blocked a ditch draining his land and that defendant had substan inadequate ditch which was allowed to become obstructed with weeds and debris. Defendant argued that the new ditch was more adequate than the old, that the flooding was caused by an extraordinary rainfall, and that the ditch was a permanent structure for which plaintiff could only recover the diminution in the value of his land but not the value of his crop. The Court of Appeals of Kentucky held that the lower court properly withdrew from the jury the question of the permanency of the ditch since all of the evidence showed that the ditch could be enlarged at a reasonable cost, thus making the measure of damages the same as in the case of a temporary structure. Affirming a judgment for plaintiff, the court noted that the infrequent or extraordinary nature of the rainfall did not mean it should not have been anticipated. (Liptak-Florida)
W71-03240

STOUT LUMBER CO V REYNOLDS (TIMBER OWNER'S LIABILITY FOR OBSTRUCTION OF STREAM BY TIMBER CUT BY INDEPENDENT CONTRACTOR).
1 SW2d 77-79 (Ark 1928).

Descriptors: *Arkansas, *Flood damage, *Obstruction to flow, *Lumbering, Water injury, Streams, Streamflow, Natural flow doctrine, Alteration of flow, Riparian land, Riparian waters, Riparian rights, Legal aspects, Judicial decisions, Adjudication procedure, Damages.

Plaintiff landowner sued defendant landowner to recover damages for flooding of plaintiff's land caused by timber, cut from defendant's land, obstructing the stream which flowed past the adjacent properties. Plaintiff contended that he was entitled to the natural flow of the stream and that defendant was liable for the flooding even though the work was done by an independent contractor. Defendant contended that there was no liability since the work was done by the independent contractor and that there would have been no flooding but for the contractor's negligence. Affirming a judgment for plaintiff, the Supreme Court of Arkansas held that evidence was sufficient to sustain the jury's verdict. The contractor's foreman had stated that the timber could not be cut without some obstruction of the stream. (Liptak-Florida)
W71-03241

BECK V STATE EX REL ATTNY GEN (RIPARIAN RIGHT TO DRAIN LAKE TO MAINTAIN NATURAL WATER LEVEL).
14 SW2d 1101-1104 (Ark 1929).

Descriptors: *Arkansas, *Lakes, *Water levels, *Drainage systems, Levees, Dams, Drains, Ditches, Flood damage, Drainage effects, Repulsion (Legal aspects), Streams, Natural flow doctrine, Obstruction to flow, Riparian land, Riparian rights, Riparian waters, Legislation, Prescriptive rights, Public rights, Recreation facilities, Legal aspects, Judicial decisions, State governments, Outlets.

Plaintiff state sued to compel defendant riparian owners to dam a ditch they had dug to partially drain a lake. Plaintiff contended that lowering the water level of the lake would damage the value of the lake to the public for hunting and fishing and that the state had a prescriptive right to maintain the water level in the lake. Defendants contended that a state-built levee had raised the level of the lake to flood heights, thereby ineffectuating their drainage systems, flooding parts of their land, and causing other parts to wash away. Defendants argued that by means of the ditch they only sought to restore the natural level of the lake by restoring the natural drainage through a bayou. The Supreme Court of Arkansas noted that flood waters are a common enemy and that riparian owners have a statutory right to remove obstructions from natural streams and drains. Reversing a judgment for plaintiff, the court held that defendant's ditch served the purpose of clearing the obstructed bayou and restoring the natural drainage and water level. This was their statutory right. (Liptak-Florida)
W71-03242

REED V CULLOR (LIABILITY FOR CROP DAMAGE CAUSED BY OBSTRUCTION OF NATURAL STREAM FLOW).
32 SW2d 296-299 (Mo 1930).

Descriptors: *Missouri, *Obstruction to flow, *Floods, *Dams, Natural streams, Water injury, Streams, Riparian land, Riparian water, Riparian rights, Flood damage, Crop response, Overflow, Stream flow, Natural flow doctrine, Watercourses (Legal), Earth dams, Rainfall, Cloudbursts, Surface runoff, Damages, Water law, Legal aspects, Repulsion (Legal aspects), Judicial decisions.

Plaintiff landowner brought action against adjacent landowner to recover for flood damage to plaintiff's crops and pasture. The damage was allegedly caused when defendant dammed up a stream flowing through both properties. Plaintiff contended that defendant's dam obstructed the flow of two natural streams, causing one to overflow and destroy a crop and causing the other to flood a pasture, destroying its rental value. Defendant denied the obstruction and contended that plaintiff's land was lower than his, that the damage was caused by heavy rainfall, and that there were no natural streams on plaintiff's land but that plaintiff's land was already inundated with surface water. Affirming a judgment for plaintiff, the court noted that a stream still existed even though its water left the defined course temporarily and later returned to the stream. The jury, under proper instructions, had properly decided the issues in favor of plaintiff. (Liptak-Florida)
W71-03243

HENICLE V PENNSYLVANIA RR (REPULSION OF SURFACE WATER BY RAILROAD).
197 NE 360-362 (Ct App Ohio 1934).

Descriptors: *Ohio, *Repulsion (Legal aspects), *Riddance (Legal aspects), *Surface runoff, Drainage, Railroads, Legislation, Surface waters, Ditches, Water conveyance, Drainage practices, Runoff, Judicial decisions, Legal aspects, Relative rights.
Identifiers: *Injunction (Mandatory).

Plaintiff landowner sought a mandatory injunction to compel defendant railroad to maintain a ditch to drain his adjoining land. Plaintiff asserted that defendant had failed to comply with a statute requiring railroads to maintain ditches to effect natural drainage. The court stated the civil law rule that a lower landowner cannot alter the natural flow of surface water from higher land. The court determined from the evidence that defendant had violated both the statute and the civil law rule. The injunction was granted. (Hart-Florida)
W71-03244

CENTRAL MAIN POWER CO V ROLLINS (RIPARIAN OWNER OF BOTH BANKS ALSO OWNS RIVER BED AND ALL WATER RIGHTS).

138 A 170-175 (Me 1927).

Descriptors: *Maine, *River beds, *Ownership of beds, *Riparian rights, Navigable waters, Rivers, Streams, Banks, Beds, Riparian land, Riparian waters, Boundary disputes, Boundaries (Property), Land tenure, Real property, Prescriptive rights, Legal aspects, Judicial decisions, Water rights.

In plaintiff's suit to quiet title to riparian land on the south bank of a river, defendant set up as a defense adverse possession of the land on both sides of the river. Affirming a judgment for defendant, the court noted that, as the riparian owner of both banks, defendant's title extended to and included the bed of the stream and all water rights. (Liptak-Florida)
W71-03245

ATLANTIC-BRIGANTINE HOTEL AND PIER CO V ISLAND DEV CO (DEFINITION OF RIPARIAN RIGHTS CONVEYED BY DEED TO SEASHORE).
145 A 330-333 (Ch NJ 1929).

Descriptors: *New Jersey, *Seashores, *Riparian rights, *Right-of-way, Piers, Docks, Recreation facilities, Shores, Oceans, Atlantic Ocean, Riparian land, Riparian waters, Land tenure, Easements, Real property, Public rights, Banks, Legal aspects, Judicial decisions, Navigable waters, Usufructuary right, Severance, High water mark.

Plaintiff vendee sued defendant vendor to set aside a deed and a mortgage to ocean front property. Plaintiff contended that defendant had failed to convey the riparian rights on the ocean, as required by the purchase contract, and had fraudulently represented his ownership of those rights. In dismissing plaintiff's claim, the court noted that the contract called only for defendant's rights in the land below high water mark. Plaintiff knew that defendant did not own any riparian rights in the ocean but only the right to obtain those rights from the riparian commissioners. (Liptak-Florida)
W71-03246

DONAHUE V CONANT (LOW WATER MARK AS LIMITING RESTRICTIVE COVENANT IN DEED TO RIPARIAN PROPERTY).
146 A 417-419 (Vt 1929).

Descriptors: *Vermont, *Lakes, *Low water mark, *Boundaries (Property), Riparian land, Riparian waters, Piers, Lake shores, Shores, Legal aspects, Judicial decisions, Real property, Easements, Land tenure, Recreation facilities.
Identifiers: Restrictive covenants.

Plaintiff riparian owner sued to enjoin defendant riparian owner from selling sodas and hot dogs in violation of a covenant in a deed from plaintiff's predecessor to defendant's predecessor. Plaintiff contended that the deed forbade the operation of any restaurant on the property and that defendant had several concession stands on the property and on a pier built out from the property over the lake shore. Reversing a decree in favor of plaintiff, the court noted that a deed to land on a public lake passes title only to the low water mark. Therefore, the concession stand on the pier, being beyond the low water mark, was not prohibited by the covenant. The court also held that the isolated sales of a few items could not be considered the 'business' of

operating a restaurant. Such sales did not violate the covenant. (Liptak-Florida)
W71-03247

NASHA HOLDING CORP V RIDGE BLDG CORP (RIPARIAN TITLE EXTINGUISHED BY SUBMERGENCE).

221 App Div 238, 223 NYS 223-231 (1927).

Descriptors: *New York, *Boundaries (Property), *Riparian land, *Submergence, Beds, Land tenure, Real property, Riparian rights, Shores, Beaches, High water mark, Legal aspects, Judicial decisions, Contracts.

Plaintiff developer brought action against defendant riparian owner to recover a down payment and to cancel a sale of riparian land. Plaintiff contended that defendant's title was unmarketable because defendant's grantor had retained a 4-foot strip between the high water mark and the conveyed property. Defendant contended that his grantor's 4-foot strip had been lost by submergence and that the grantor's claim was not a cloud on the title. Reversing a judgment for plaintiff, the court held that submergence extinguishes ownership of riparian land and that defendant, although not the orginal riparian owner, was now the riparian owner with all riparian rights. Since the 4-foot strip had been lost by submergence, defendant's grantor had no claim against defendant's title. (Liptak-Florida)
W71-03248

BOARD OF SUP'RS V WATER POWER AND CONTROL COMM'N (REVIEW OF ORDER AUTHORIZING NEW MUNICIPAL WATER SUPPLY).
227 App Div 345, 238 NYS 55-61 (1929).

Descriptors: *New York, *Water supply, *Municipal water, *Administrative decisions, Potable water, Dams, Reservoirs, Water demand, Administrative agencies, Water policy, Water consumption, Legal aspects, Judicial decisions, Eminent domain, Condemnation, Cities, Local governments.

Plaintiff county board of supervisors sought review of an order of defendant state water commission. The order authorized a city to condemn certain property to be used as an additional water supply. Plaintiff contended that the order was arbitrary and unreasonable since a more suitable, more efficient, and less expensive water supply could be obtained from another source without damaging plaintiff's property. Defendant contended that it lacked authority to choose between the site selected by the city and another site. The court held that defendant did have authority to approve a site different from that selected by the city. However, the defendant had already determined that the proposed site would provide the best water supply for the least cost. The order was affirmed. (Liptak-Florida)
W71-03249

OYSTERMEN'S DOCK CO V DOWNING (VALIDITY OF LEASE OF TIDAL BOTTOM).
137 Misc 376, 241 NYS 675-676 (1930).

Descriptors: *New York, *Beds, *Leases, *Cities, Bays, Ownership of beds, Local governments, Public rights, Public lands, Tidal waters, Navigable waters, Legal aspects, Judicial decisions, Administrative decisions, Legislation, State governments.

Plaintiff dock company sued to compel defendant town supervisor to execute a lease of land under water owned by the town, which lease had been approved by the town council but opposed by public referendum. The court held that defendant's signature on the lease was a mere ministerial act and must be compelled in the absence of fraud in securing the lease. (Liptak-Florida)
W71-03250

IN RE PUBLIC BEACH IN CITY OF NEW YORK (CONDEMNATION VALUE OF OCEAN-FRONT RIPARIAN RIGHTS).
230 App Div 407, 245 NYS 121-124 (1930).

Descriptors: *New York, *Beaches, *Riparian rights, *Condemnation value, Shores, Coasts, Riparian land, Riparian waters, Condemnation, Eminent domain, Value, Property values, Land appraisal, Beds, Ownership of beds, Public rights, Real property, Seashores, Cities, Governments, Oceans, Legal aspects, High water mark, Tidal waters, Judicial decisions, Easements, Access routes, Navigable waters.

Plaintiff city, to establish a public beach, brought condemnation proceedings against defendant landowners seeking to acquire riparian and submerged lands and riparian rights. The court noted that those owners who had been granted submerged land and foreshore by the state were entitled to compensation for loss of their title. The trial court had erred in establishing an arbitrary and uniform award per lineal foot for loss of riparian rights along the ocean. The value of such rights should be determined by the diminished value of each parcel affected. The court also noted that owners who had been cut off from access to the water did not retain an easement of access since their riparian rights had been extinguished and they had been compensated therefor. (Liptak-Florida)
W71-03251

KENWELL V LEE (VALIDITY OF WATER DISTRICT CREATION AND BOND ISSUE).
142 Misc 413, 254 NYS 841-851 (1932).

Descriptors: *New York, *Water districts, *Water supply, *Assessments, Cities, Governments, Reservoirs, Lakes, Pipelines, Municipal water, Potable water, Water demand, Water rates, Taxes, Water works, Water sources, Legal aspects, judicial decisions, Administrative decisions, Adjudication procedure.

Plaintiff taxpayer brought action against defendant town supervisor to invalidate a bond issue and the establishment of a water district. Plaintiff contended that the plans for the proposed water system differed from those originally approved by the petition, that the use of a forest preserve lake for a water supply was unconstitutional, and that apportionment of the cost among all the taxpayers instead of those directly benefited was also unconstitutional. Dismissing plaintiff's claim, the court noted that certain changes in construction plans after the establishment of a water district are contemplated by those petitioning for the district, especially where the changes result in improved services at less cost. The court also noted that a natural lake with the proper intake pipes and modifications is a reservoir within the statutorily permitted use of preserve lands for water systems. Also, the system's benefits to the whole town justified a general tax to pay for the balance of the cost above the proceeds from the bond issue and from water rates. (Liptak-Florida)
W71-03252

PEOPLE V TOMPKINS-KIEL MARBLE CO (STATE TITLE TO SUBMERGED LAND UNDER RIGHT OF RE-ENTRY FOR CONDITION BROKEN).
148 Misc 559, 265 NYS 243-246 (1932).

Descriptors: *New York, *Land tenure, *Prescriptive rights, *Ownership of beds, Adjudication procedure, Real property, Beds, Beds under water, Judicial decisions, Legal aspects, State governments.

Plaintiff state brought action to defease defendant from all interest in a tract of submerged land. Plaintiff had granted to defendant's predecessor in interest a patent in submerged land, subject to a right of re-entry for condition broken, the condition being to fill the land and use it for commerce within five years. Plaintiff's grantee failed to satisfy the condition, and defendant received the tract through conveyances from him. Defendant moved to dismiss plaintiff's action on the ground that it was barred by the statute of limitations. Since plaintiff's grantee had never taken possession, plaintiff asserted that the action was not barred. The court rejected plaintiff's assertion. Determining that plaintiff's right to sue for re-entry had accrued 40 years prior, and that defendant's continued possession was presumed so that proof of adverse possession was unnecessary, the court granted defendant's motion. (Hart-Florida)
W71-03253

PEOPLE V HAVEMEYER AND ELDER, INC (STATE TITLE TO FORMERLY SUBMERGED LAND UNDER RIGHT OF RE-ENTRY).
148 Misc 555, 265 NYS 249-253 (1933).

Descriptors: *New York, *Land tenure, *Ownership of beds, *Docks, Real property, Beds, Beds under water, Bulkhead line, Bulkheads, Piers, Judicial decisions, Legal aspects.
Identifiers: *Commerce.

Plaintiff state brought action to defease defendant riparian landowner under a right of re-entry for condition broken. Plaintiff had conveyed submerged land to defendant on the condition that the land be filled and docks erected to promote commerce. Defendant had filled the property to the bulkhead line and erected piers and bulkheads, operating a manufacturing plant and freight terminal on the premises. Plaintiff asserted that this use did not comply with the condition, since the freight terminal was not open to the public, and that defendant had leased the terminal, therefore failing to promote commerce. The court held that defendant's action clearly promoted commerce and therefore that plaintiff had no right of re-entry. Defendant's motion to dismiss was granted. (Hart-Florida)
W71-03254

WESTCHESTER JOINT WATER WORKS NO 1 V VILLAGE OF PELHAM (WATER WORKS SEEKS TO ENJOIN CITY FROM SUPPLYING ITS OWN WATER).

148 Misc 349, 265 NYS 491-494 (1933).

Descriptors: *New York, *Water works, *Cities, *Water supply, Legislation, Hydrants, Water distribution (Applied), Water rates, Water conveyance, Administrative agencies, Administrative decisions, Legal aspects, Judicial decisions, Remedies.

Plaintiff water works sued to enjoin defendant city from constructing its own water works system without securing approval of the Water Power and Control Commission. Plaintiff was furnishing defendant with water and had installed fire hydrants in the city. Defendant planned to furnish its own water and had petitioned the Commission for approval. However, the Commission refused jurisdiction because of a statute empowering municipalities to receive water from New York City without approval. Plaintiff asserted that approval was required. The supreme court held that no approval was required for defendant to operate its own system. Since plaintiff did not possess an exclusive franchise or have its rates fixed by a state body, plaintiff had no right to enjoin defendant's actions. (Hart-Florida)
W71-03255

GUCKER V TOWN OF HUNTINGTON (RIPARIAN OWNER'S TITLE TO SANDBAR BY ACCRETION).
241 App Div 494, 272 NYS 45-49 (1934).

Descriptors: *New York, *Sand bars, *Dredging, *Accretion (Legal aspects), Land tenure, Boundaries (Property), Boundary disputes, Currents

(Water), Sand spits, Shoals, Shallow water, Bays, Inlets (Waterways), Real property, Riparian land, Riparian rights, Navigable waters, Cities, Legal aspects, Judicial decisions.

Plaintiff riparian landowners brought action to set aside quitclaim deeds to a sandbar as clouds upon title. Plaintiffs' land ran to the water's edge, and the disputed sandbar lay some 400 to 700 feet from plaintiffs' boundary. It had been formed by accretion over a period of years, but remained below water level until it was dredged and filled to about 1 foot above water level. Plaintiffs asserted that before the dredging the sandbar was formed by accretion from their upland and therefore that the boundary of their property had been extended by the accretion to include the sandbar. Determining that no evidence showed that the accretion had formed from plaintiffs' uplands, and that 400 to 700 feet of water lay between the uplands and the sandbar, the court held that plaintiffs had not established title in the sandbar. Moreover, the quitclaim deeds were no cloud upon their upland titles. Noting that the dredging was a possible invasion of plaintiffs' riparian rights, the court left plaintiffs free to seek further remedy. (Hart-Florida)
W71-03256

PITSHIP DUCK CLUB V TOWN OF SEQUIM (NAVIGABILITY OF DUCK HUNTING LAGOON).
315 F Supp 309-311 (WD Wash 1970).

Descriptors: *Federal jurisdiction, *Navigable waters, *Non-navigable waters, *Lagoons, Inlets (Waterways), Legislation, Recreation, Hunting, Tidal waters, Judicial decisions, Legal aspects, Cities, Adjudication procedure, Jurisdiction.

Plaintiff duck hunting club sued defendant township for damages caused by defendant's dike, and alternatively sought an injunction to prevent maintenance of the dike. Plaintiff owned property on a peninsula, with a lagoon on one side and strait on the other. Defendant's dike across the lagoon prevented plaintiff from reaching its property by small boat. Defendant alleged lack of jurisdiction in the federal courts because the lagoon was non-navigable, and therefore laws of the United States were inapplicable. The court stated that: (1) a waterway is navigable if suitable for use as a highway of commerce; (2) a water is suitable for such use if presently suitable, suitable in the past, or potentially suitable in the future with reasonable improvements; (3) a waterway can be made suitable only if the improvements are economically feasible; and (4) the existence of tidewaters does not make waters navigable. Since the lagoon was suitable for use only as an access to the duck hunting property, the court held that it was non-navigable. The action was dismissed for want of jurisdiction. (Hart-Florida)
W71-03257

PENNSYLVANIA ENVIRONMENTAL COUNCIL, INC V BARTLETT (HIGHWAY RELOCATION ENDANGERS STREAM ECOLOGY).
315 F Supp 238-253 (MD Pa 1970).

Descriptors: *Ecology, *Highway relocation, *Non-navigable waters, *Highways effects, Rivers and Harbors Act, Road construction, State governments, Roadbanks, Road design, Sediment control, Legislation, Federal government, United States, Administrative agencies, Balance of nature, Environmental effects, Judicial decisions, Legal aspects.

Plaintiff environmental council sought an injunction to restrain defendant Pennsylvania secretary of highways, in relocating a road, from encroaching upon a stream. Defendant's planned relocation included a landfill in a stream. Plaintiff contended such landfill would harm the stream's ecology. Among other things, plaintiff asserted that the construction would violate the Rivers and Harbors Act which required that construction of a dike on a navigable river receive congressional approval. Assuming arguendo that the proposed construction would be a dike, stating that a river is navigable in law when navigable in fact, and relating a test that a stream is navigable if it is presently, was, or could be reasonably made suitable for use in commerce, the court held the Rivers and Harbors Act inapplicable. The evidence showed that the stream was non-navigable. Accordingly, the injunction sought by plaintiff was denied. (Hart-Florida)
W71-03258

UNITED STATES V 544 ACRES OF LAND (CHALLENGE OF TVA CONDEMNATION AS ULTRA VIRES).
314 F Supp 273-277 (ED Tenn 1969).

Descriptors: *Tennessee, *Real property, *Eminent domain, *Tennessee Valley Authority Project, Administrative agencies, Condemnation, Adjudication procedure, Administrative decisions, Federal government, United States, Federal project policy, Political aspects, Legal aspects, Judicial decisions.

Plaintiff United States sought summary judgment in eminent domain proceedings against defendant land. The owners of the land asserted that relator Tennessee Valley Authority's condemnation was ultra vires. The court noted that the necessity of condemnation for public use was a purely political question for the legislative branch and that neither the amount, character, or specificity of the particular acreage to be acquired was a subject for judicial inquiry. Congress had delegated condemnation authority to relator who, in seeking congressional appropriation for the project, had fully advised Congress of the nature, scope, and purpose of the condemnation. Defendant could not complain of the delegation of authority to relator. Holding that relator was fully empowered to condemn the land, and that no material issue of fact existed, the court gave summary judgment for plaintiff. (Hart-Florida)
W71-03259

UNITED STATES V FLORIDA POWER AND LIGHT CO (THERMAL POLLUTION OF BISCAYNE BAY).
311 F Supp 1391-1392 (SD Fla 1970).

Descriptors: *Florida, *Water pollution, *Pollution abatement, *Thermal pollution, Water pollution sources, Cooling water, Industrial wastes, Ecology, Aquatic microbiology, Balance of nature, Judicial decisions, Legal aspects, Bays, Inlets (Waterways), Remedies, Powerplants.
Identifiers: *Injunction (Prohibitory).

Plaintiff United States sought an injunction to restrain defendant power company from discharging heated water into Biscayne Bay. Having determined that the plant's operation was not causing irreparable harm to the bay's ecology, the court refused to grant the preliminary injunction sought. The court noted that the existing thermal pollution was causing minimal retrievable damage, but defendant was planning to reduce this to a benign level by 1971. (Hart-Florida)
W71-03260

FLOOD AND EROSION CONTROL (PROJECT AUTHORITY AND ADMINISTRATION).

Iowa Code Ann secs 467B. 1-467B. 15 (Supp 1969).

Descriptors: *Iowa, *Adninistrative agencies, *Flood control, *Erosion control, Legislation, Costs, Construction, Levees, Easements, Federal government, Cost sharing, Watershed management, Project planning, Maintenance, Soil conservation, Water management (Applied), Administration, Water utilization, Land, Flood protection, Financing, Cost allocation, Taxes, Coordination, Local governments.

Outlined in this Iowa legislation are the operation of flood and erosion control projects in Iowa and water conservation, development, utilization, and disposal projects by state and local agencies in cooperation with the federal government. Counties where projects are to be carried on are given jurisdiction and authority through the board of supervisors to construct, operate and maintain projects on county lands. Such projects are presumed to be for the protection of public roads and lands and for public health and general welfare. In implementing projects counties may accept federal aid in accordance with chapter provisions and may cooperate with any federal, state or local agency. Cooperation between agencies is authorized. Chapter provisions outline allocation of various project costs, maintenance costs, taxes, and payments from the Federal Government. Other provisions describe the duties of soil conservation commissioners regarding flood and erosion control projects and the applicable law and procedure in maintenance of projects. (Duss-Florida)
W71-03261

ESTABLISHMENT AND OPERATION OF METROPOLITAN SEWERAGE COMMISSIONS.
8 Wis Stat Ann sec 59.96 (1957) as amended (Supp 1970).

Descriptors: *Wisconsin, *Administrative agencies, *Cities, *Sewage districts, Sewage disposal, Sewage treatment, Sewers, Pumping plants, Watercourses (Legal), Drains, Water supply, Potable water, Construction, Legislation, Surface water, Easements, Permits, Conduits, Condemnation, Diversion, Water pollution, Local governments, administration, Sewage, Legal aspects.

In counties with more than 500,000 population, which have passed resolutions declaring the need for sewage disposal works, and which have qualified and appointed sewerage commissions, this Wisconsin legislation provides for appointment of sewerage commissioners. Metropolitan sewerage commissions may by resolution add to their district other areas within their county where such areas drain or may drain sewage into water which is or may be used as a source of drinking water. Procedures are outlined for adding such areas. The sewerage commissions have the power and duty to plan and construct sewers, pumping and temporary disposal works for the collection and transmission of various types of sewage. Commissions may improve watercourses and divert water as long as they comply with procedures outlined in the statute. Commissions may promulgate rules and regulations for the operation of their systems and may acquire land needed to implement systems. Except as allowed by the statute, the commissions' power shall not extend to first class cities implementing their own sewerage system. Financing of improvements and tax levying procedures are also outlined. (Duss-Florida)
W71-03262

LIABILITY OF COUNTY COMMISSIONERS IN SUITS INVOLVING PUBLIC HIGHWAYS AND BRIDGES.
Ohio Rev Code Ann sec 305.12 (1953).

Descriptors: *Ohio, *Highways, *Local governments, *Remedies, Legal aspects, Adjudication procedure, Legislation, Roads, Bridges, Levees, Governments, Administration, Grading, Embankments, Paving, Roadbanks, Road construction, Maintenance, Ditches, Drains, Damages, Bridge failure, Bridge construction, Watercourses (Legal), Repairing.

The board of county commissioners may bring or defend any suit involving injury to any public, state, or county road, bridge, ditch, drain, or watercourse established by such board in its county. The board is liable in its official capacity for any damage resulting from its negligence in repairing such public facilities. (Dye-Florida)
W71-03263

DRAINAGE DISTRICTS (ANNEXATION, REPAIR, CONSTRUCTION, IMPROVEMENT: COUNTY COURT JURISDICTION).
13 Mo Ann Stat secs 243.140-243.230 (1952).

Descriptors: *Missouri, *Surface drainage, *Drainage districts, *Administration, Administrative agencies, Legislation, Ditches, Drains, Bridges, Culverts, Maintenance, Benefits, Damages, Outlets, Contracts, Projects, Land tenure, Planning, Channels, Construction, Taxes, Swamps, Jurisdiction, Legal aspects, Repairing.

Stating that county courts shall have jurisdiction over such matters, this Missouri legislation outlines circumstances and procedures under which lands outside of drainage districts may be annexed to them. Also, the county court in a drainage district has the power to authorize the construction, repair or improvement of works for the district. The court's discretionary power in this area is outlined, and procedures are established. County-owned swamp lands which benefit from drainage-district works shall be assessed as to benefits and damages as any other land. After confirmation of the viewers' and engineers' reports assessing benefits and damages, the court shall appoint a competent drainage district engineer. His duties and powers are outlined. The county court shall approve or reject all contracts and bonds of the district. Defaulting contractors are liable for all damages, costs and expenses occasioned by their default. Procedures are outlined for construction or enlargement of any bridge or culvert in conjunction with the construction of drainage ditches. Chapter provisions also apply to channels and sloughs where the district has constructed outlets. (Duss-Florida)
W71-03264

TUCKER V HAGAN (LIABILITY FOR DISCHARGE OF SURFACE RUNOFF UNTO SERVIENT ESTATE).
300 SW 301-305 (Mo 1927).

Descriptors: *Missouri, *Diversion, *Riddance (Legal aspects), *Surface runoff, Alteration of flow, Natural flow doctrine, Railroads, Culverts, Judicial decisions, Legal aspects, Ditches, Conveyance structures, Rivers, Watercourses (Legal), Relative rights, Floods, Adjudication procedure.

Defendant managed property adjacent to plaintiff's farmland. Both tracts were bounded on the north by a river and on the south by a railroad track. During rainy seasons, water flowed through a railroad culvert, then along a depression on defendant's land and emptied into the river. This culvert became obstructed, forcing water to flow along the side of the railroad track until it emptied into the river across the corner of plaintiff's property. Defendant cleared the culvert and constructed a ditch from the culvert, along the railroad track, near the line between both parties' property. The water, not under control after it passed through the ditch, inundated plaintiff's lower land. Plaintiff's successful action for damages to his crops was affirmed by the St. Louis Court of Appeals. The court stated that although landowners have the right to divert surface water from their premises, a dominant proprietor may not collect surface water and discharge it by artificial means, in increased volume, onto a servient estate. Plaintiff was not required to show negligent construction of the ditch, only wrongful discharge of water. (Powell-Florida)
W71-03265

BRUSH V LEHIGH VALLEY COAL CO (LIABILITY FOR COAL WASTE DEPOSITION).
290 Pa 322, 138 A 860-863 (1927).

Descriptors: *Pennsylvania, *Coal mine wastes, *Navigation, *Rivers and Harbors Act, Pollutants, Water pollution, Water pollution effects, Water pollution sources, Damages, Flooding, Wastes disposal, Navigable waters, Legislation, Federal Government, Obstruction to flow, Riparian land, Riparian waters, Riparian rights, Easements, Stream overflow, Judicial decisions, Legal aspects.

Plaintiff landowner sought to recover damages for injury to his land caused by the flooding of an adjacent river. The river had been polluted by coal wastes from defendant's upstream colliery. Defendant interposed as a defense a release from liability which had been granted by plaintiff's predecessor in title. Plaintiff contended that such a release was void as: (1) in violation of congressional act; (2) as authorizing the creation of a public nuisance; and (3) as against public policy. The court held that the release did not violate the congressional act preventing deposits which obstruct navigable waters since no interference with navigation was shown to result from defendant's coal waste deposits. Moreover, no proof as to the river's navigability at the point of waste deposit was shown, thus negating the applicability of the act which required a showing of navigability. The court also found that plaintiff, based upon a period of prescription, had granted defendant an easement to do the acts complained of. A contention that the release was void because it purported to exempt defendant from liability for negligence was discarded because there was no showing of negligence at trial. The lower court's decision was affirmed. (Barnett-Florida)
W71-03266

S S KRESGE CO V RAILROAD COMM'N (NO RIPARIAN RIGHT TO ERECT STRUCTURES IN NAVIGABLE RIVER WITHOUT STATE CONSENT).
236 NW 667 (Wis 1931).

Descriptors: *Wisconsin, *Navigable waters, *Structures, *Permits, Riparian rights, Rivers, Streams, Navigable rivers, Riparian land, Riparian waters, Beds, Riverbeds, Regulation, Navigation, Buildings, State governments, Legislation, Legal aspects, Judicial decisions.

On motion for rehearing in an action involving plaintiff corporation's right to replace a building on a navigable river, the court noted in a per curiam opinion that a riparian owner has no right, without state consent, to erect any structure in the bed of a navigable river. It does not matter that the structure is in aid of navigation. The court also noted that the state could not approve such a structure if it would preclude the state from later requiring the structure's removal when necessary to aid navigation. (Liptak-Florida)
W71-03267

MCWHORTER V CITY OF CLARKSBURG (PRESCRIPTIVE RIGHT TO OVERFLOW LAND AS A DEFENSE).
161 SE 577-580 (W Va 1931).

Descriptors: *West Virginia, *Dams, *Flooding, *Prescriptive rights, Flow, Land, Real property, Streams, Water storage, Legal aspects, Judicial decisions, Adjudication procedure, Cities, Local governments, Mill dams, Mills, Structures, Riparian rights, Obstruction to flow, Condemnation, Damages, Remedies.

Defendant city constructed a dam on the site of an old gristmill, flowing plaintiff's lands. Plaintiff sought damages for the value of the land flowed, contending that the property flowed had been condemned and that plaintiffs were entitled to compensation. Defendant contended that the operation of the gristmill without condemnation of flowage rights had created a prescriptive right in defendant to flow the same land for general purposes. The trial court instructed the jury to award damages to plaintiff if his land was flowed, ignoring defendant's defense of prescriptive right. The jury found for plaintiff. The Supreme Court of Appeals of West Virginia reversed the trial court, and a new trial was ordered. A binding jury instruction which ignores a legal defense supported by substantial evidence is erroneous. The maintenance of the original dam for mill purposes entitled the mill owners and their successors to continue its use, to the extent that the servitude was not increased, for general purposes. (Dye-Florida)
W71-03268

KITCHEN LUMBER CO V TALLASSEE POWER CO (WASHOUT OF RAILROAD BRIDGE CAUSED BY NEGLIGENT OPENING OF DAM FLOODGATES).
For primary bibliographic entry see Field 04A.
W71-03269

NECHES CANAL CO V MILLER AND VIDOR LUMBER CO (LOSS OF PROFITS FROM UNLAWFUL DAM ERECTION).
24 F2d 763-765 (5th Cir 1928).

Descriptors: *Dams, *Lumbering, *Water pollution, *Permits, Legislation, Water supply, Administrative agencies, Water pollution sources, Pollutants, Water pollution effects, Rivers, Saline water, Sea water, Saw mills, Luber, Profit, Depreciation, Damages, Judicial decisions, Legal aspects, Obstruction to flow.

Plaintiff lumber company sought to restrain defendant from maintaining a dam obstructing the free and open navigation of the Neches River. Plaintiff used the river to transport logs and contended that defendant had not obtained for the dam the express authority required by statute. Plaintiff also sought to recover damages caused by the erection of the dam. Defendant city had erected the dam to prevent the pollution of its water supply from salt water, dead fish and other debris which traveled up the river from the Gulf of Mexico during times of temporary drought conditions. Plaintiffs contended that as a result of damming the river their logs became watersoaked and sank, that they were unable to maintain their normal level of business, and that the mill had to be closed. The appellate court affirmed the lower court decision for plaintiffs, stating that the obstruction was unlawful. Defendant had not obtained governmental approval prior to construction. However, the amount of damages as determined in the court below was modified. (Hart-Florida)
W71-03270

NEWTOWN CREEK TOWING CO V ASTORIA IMPORTING AND MFG CO (DAMAGE TO TUG BY LUMBER).
47 F2d 578-579 (2d Cir 1931).

Descriptors: *Admiralty, *Ships, *Lumber, *Navigable rivers, Boats, Propellers, Lumbering, Navigation, Judicial decisions, Legal aspects, Adjudication procedure, Piers.

Libelant towing company brought libel against respondent importing company for damages allegedly caused by libelant's striking one of respondent's logs in a navigable river. Respondent imported mahogany logs for veneer. These logs were towed upriver and secured to respondent's wharf by individual lines and a log boom enclosure. Libelant's tug came upriver at night, passing and seeing respondent's logs secured to the wharf, picked up a coal barge and proceeded back downriver. As the tug and barge passed respondent's wharf, the tug hit an obstruction. Libelant asserted that it had struck one of respondent's logs. The court noted that respondent had a duty to secure its logs with reasonable care, but concluded that libelant had not proven that the obstruction was one of respondent's logs. The libel was dismissed. (Powell-Florida)
W71-03271

BARR V SPALDING (UNITED STATES' LIABILITY FOR RAISING RIVER ABOVE HIGH WATER MARK).
46 F2d 798-802 (WD Ky 1927).

Descriptors: *High water mark, *Ownership of beds, *Flooding, *United States, Kentucky, Navigable rivers, Land tenure, Adjudication procedure, Ohio River, Low water mark, Boundaries (Property), Navigation, Dams, River beds, Riparian rights, Judicial decisions, Legal aspects, Eminent domain, Beds under water, Riparian land, Easements.
Identifiers: *Constitutionality.

Plaintiff riparian landowner sought to restrain defendant district engineer from building a dam on the Ohio River. On defendant's motion to dismiss, the court stated that: (1) whether a riparian owner holds title in a navigable streambed is a question of local law; (2) in Kentucky, a riparian owner is presumed to hold title to the thread of a stream, but this presumption may be overcome by contrary language in the deed; (3) title in land to the low water mark is subject to Congress' paramount right to improve navigation; (4) the United States' power to improve navigation is limited only by the fifth amendment; (5) the United States may raise the level of a stream to the high water mark without a fifth amendment 'taking'; and (6) threatened damages to riparian land do not constitute a 'taking'. The court concluded that plaintiff's deed conveyed title only to the low water mark. Accepting plaintiff's contention that land above the high water mark was threatened, the court denied defendant's motion. On final submission, defendant conceded liability for an injury above high water mark, and the court accordingly dismissed the action. (Hart-Florida)
W71-03272

PADUCAH-ILLINOIS RR V GRAHAM (RAILROAD PROPERTY SUBJECT TO AD VALOREM TAXATION).

46 F2d 806-811 (WD Ky 1931).

Descriptors: *Ohio River, *Kentucky, *Taxes, *Boundaries (Property), Boundary disputes, Navigable rivers, Railroads, Ownership of beds, River beds, Judicial decisions, Legal aspects.

In an action concerning the amount of plaintiff railroad's property subject to ad valorem taxation by defendant sheriff representing the Kentucky school district, the court stated that the portion of the Ohio River bed lying between thread of the river and low water mark on the northern bank was unappropriated state land, despite its inclusion within the Kentucky boundary. (Hart-Florida)
W71-03273

THE COLOMBO (DISCHARGE OF OIL INTO NAVIGABLE WATERS).
42 F2d 211-212 (2d Cir 1930).

Descriptors: *Rivers and Harbors Act, *Ships, *Water pollution, *Oil, Legislation, United States, Water pollution sources, Water pollution control, Pollutants, Pollution abatement, Federal government, Judicial decisions, Legal aspects, Admiralty.

United States brought libel against the vessel Colombo for discharge of oil into navigable waters of the United States. A federal statute provided strict liability for discharging various substances but did not expressly include oil. However, the court held that the language of the statute was sufficiently broad to include oil. Since the discharge was inadvertent, the court applied the minimum penalty. (Hart-Florida)
W71-03274

FLAMBEAU RIVER LUMBER CO V LAKE SUPERIOR DIST POWER CO (OBSTRUCTION OF NAVIGABLE STREAM BY IMPROPER DAM OPERATION).
227 NW 276-278 (Wis 1929).

Descriptors: *Wisconsin, *Dams, *Lumbering, *Hydroelectric plants, Lumber, Adjudication procedure, Judicial decisions, Legal aspects, Banks, Overflow, Gates, Floodgates.

Plaintiff lumber company sued defendant power company for damages from unlawful obstruction of a navigable stream. Plaintiff's complaint alleged that defendant, by erecting its dam, had raised the water level over stumps and various standing and fallen timber which should have been removed before building the dam. This and defendant's unreasonable opening and closing the gates of the dam had caused plaintiff's lumber to be trapped in these stumps and timber. Defendant asserted that the complaint failed to state a cause of action because it alleged conclusions of law rather than facts. Stating that defendant could not bey demurrer compel plaintiff to set up and anticipate its defenses in the complaint, the court held that the complaint stated a cause of action. (Hart-Florida)
W71-03275

BENEDICT V LUNN (CLAIM FOR REFUND BASED UPON INVALID GRANT OF TITLE TO LAND).
244 NY 373, 155 NE 677-679 (1927).

Descriptors: *New York, *Ownership of beds, *Land tenure, *State governments, Legal aspects, Judicial decisions, Remedies, Local governments, Administrative agencies, Contracts, Legislation, Riparian land, Streambeds, Landfills, Shores, Boundary disputes, Boundaries (Property), Beds under water.

Plaintiff's predecessor-in-title had purchased from the state certain lands under a creek adjacent to his upland. Title to the land in question had been litigated previously and was found to lie in the City of New York. As a result, the state's attempted grant to plaintiff's predecessor was void. Plaintiff sought the return of the purchase money. Defendant state land commissioners contended that the decision of the previous case was not binding and also that plaintiff's predecessor-in-title had purchased not a fee title, but only a franchise to fill in the submerged land within a five-year period. Having failed to fill the land, the franchise had expired. The Court of Appeals of New York, in reversing a lower court decision for defendant, held that the previous case was binding authority as to title. The state had attempted to grant fee title, subject to divestment if the land was not filled within five years. However, since the state had no title to grant, plaintiff could not lose such title for failure to satisfy the condition. Plaintiff did not have title under his grant from the state, and he was entitled to reclaim his purchase money. (Morris-Florida)
W71-03276

MORTON V CHESAPEAKE AND O RY (ALTERATION OF STREAM'S COURSE AS PERMANENT OR TEMPORARY INJURY).
240 Ky 199, 41 SW2d 1110-1111 (1931).

Descriptors: *Kentucky, *Adjudication procedure, *Damages, *Alteration of flow, Streams, Water injury, Landfills, Rocks, Erosion, Pile foundations, Legal aspects, Judicial decisions, Obstruction to flow, Railroads.

Plaintiff landowner sued defendant railroad company for damages to land. A small creek ran on defendant's right-of-way. Defendant's railroad track was placed on a fill 25 feet high, and defendant placed rocks in the creek to prevent it from eroding the fill. Plaintiff contended that the rocks caused the stream to cut an alternate course through his land. Plaintiff appealed from a lower court judgment awarding him only $300 of $2000 requested, asserting error for failure to instruct the jury on the measure of damages for a temporary structure. Plaintiff contended that where the injury was caused by failure to use due care to protect adjacent property, or where the structure could be removed at reasonable expense, damages may be recovered for each invasion. Defendant contended that the structure was permanent and necessary and could not be removed without an unreasonable and disproportionate cost. The court held that since the jury instructions had not been included in the record by court order, the exceptions to the instructions could not be considered. The lower court's decision was affirmed. (Hart-Florida)
W71-03277

STATE V BROAD RIVER POWER CO (STATE'S POWER TO GRANT CANAL LAND).
181 SE 41-56 (SC 1935).

Descriptors: *South Carolina, *Electric power, *Canals, *Claims (Contracts), State governments, Legal aspects, Judicial decisions, Adjudication procedure, Governments, Land, Real property, Navigable waters, Navigation, Contracts, Contract administration, Negotiations, Performance, Land tenure, Electric power industry, Legislation, Public utilities, Industries, Utilities.
Identifiers: *Constitutionality.

Defendant power company acquired property from plaintiff state along with the right to construct canals and power generating facilities on a river. In return defendant agreed to extend a canal and provide certain services to plaintiff. Defendant failed to perform some of the acts required by the contract, but plaintiff, in an earlier action, was denied title to the property by forfeiture. Plaintiff and defendant then entered into a new contract whereunder defendant was obligated for money payments in lieu of the services required by the original contract. Plaintiff's attorney general sought in the instant action to have the later agreement declared unconsitutional under a provision prohibiting donations of public land by the state. The Supreme Court of South Carolina affirmed a lower court judgment for defendant. The constitutional provision referred only to land, not to other contractual property rights. In addition, defendant's new monetary obligation rebutted the existence of a donation by plaintiff. Also, a navigation trust imposed on navigable waters did not extend to land granted for the construction of a canal. (Dye-Florida)
W71-03278

COLONNA V STATE (RIGHT OF LESSOR TO RECOVER LOST PROFITS WHEN STATE'S NEGLIGENCE PREVENTS MINING).

224 App Div 173, 230 NYS 19-24 (Sup Ct 1928).

Descriptors: *New York, *Leases, *Quarries, *Canal seepage, Compensation, Mining, Gravels, Rock excavation, Canals, State governments, Mine drainage, Mine water, Exploitation, Contracts, Real property, Leakage, Water loss, Legal aspects, Judicial decisions, Remedies, Damages.
Identifiers: *Negligence.

Plaintiff lessor brought action to recover lost profits caused by defendant state's negligence. Plaintiff had leased a quarry on his land to a third party, agreeing to receive in consideration 8% of the market value of the stone produced. The lessee was unable to pump the water from the quarry to begin operations because a nearby canal constructed by defendant state leaked into the quarry. The lessee sued defendant and recovered his lost profits, less the royalties due plaintiff, and plaintiff then sued to recover his 8%. Defendant contended that plaintiff's profits were contingent upon sale of the stone, and that since no stone was quarried, plaintiff could not recover. Plaintiff asserted that the agreement was not for the sale of the stone, but for a lease of the property. Determining that a mining lease was a lease of land, rather than a sale of the excavated material, the court held that plaintiff could recover. (Hart-Florida)
W71-03279

HYDRAULIC RACE CO V GREENE (USE OF SURPLUS WATER FROM NEW YORK BARGE CANAL).

133 Misc 410, 233 NYS 49-63 (Sup Ct 1928).

Descriptors: *New York, *New York State Barge Canal, *Leases, *Surplus water, Legislation, State governments, Administrative agencies, Canals, Legal aspects, Judicial decisions, Relative rights.

Plaintiff lessee brought action to enjoin defendant interloper from interfering with plaintiff's use of surplus water from the New York State Barge Canal. Plaintiff's predecessors had acquired a perpetual lease on the surplus water from the original Erie Canal. As subsequent enlargement of the canal greatly increased the amount of surplus water, plaintiff used this additional water as well as the water authorized by the lease. Defendant claimed the right to use this excess water. Plaintiff contended that the original lease authorized him to use any water, exceeding the amount of the original lease, created by enlargement of the canal. Interpreting the statute authorizing lease of the surplus water, and plaintiff's lease, the court determined that the statute permitted the canal commissioners to lease only that water which was surplus at that time; the lease conveyed only that amount. Furthermore, the court held that the state's acquiescence in plaintiff's use of the additional water, and construction of raceways for surplus water, did not alter the character of the lease. Accordingly, plaintiff's complaint was dismissed. (Hart-Florida)
W71-03280

MILLER V MCLAUGHLIN (ABILITY OF STATE TO REGULATE FISHING IN RIVER OVER WHICH SISTER STATE HAS CONCURRENT JURISDICTION).
281 US 261, 50 S Ct 296-297 (1930).

Descriptors: *Nebraska, *Iowa, *Fishing gear, *Interstate rivers, Fish conservation, Nets, Fish, Sport fishing, Legal aspects, Judicial decisions, Legislation, Jurisdiction, Fishing, Federal government, State governments, Regulation.
Identifiers: *Constitutionality.

Plaintiff Nebraska resident sought to enjoin enforcement by defendant state of Nebraska of a statute prohibiting the possession or use of fishing nets, traps, or seins. The middle of the Missouri River formed the border of Iowa and Nebraska, and an act of Congress gave Iowa and Nebraska concurrent jurisdiction over the River. Iowa statutorily authorized the use of nets within its waters. Plaintiff contended that: (1) Nebraska could not enforce its anti-seining statute without the concurrence of Iowa and, (2) prohibiting the mere possession of fishing instruments constituted a denial of due process. The Supreme Court of the United States held that concurrent jurisdiction by a sister state does not deprive a state of the right to regulate fishing on areas of the river within its own territory. Upholding the validity of Nebraska's statute, the court ruled also that prohibiting the mere possession of fishing implements within a state does not deny due process. Plaintiff was refused injunctive relief. (Earl-Florida)
W71-03281

VERMONT V NEW HAMPSHIRE (STATE BOUNDARY LINES AS DETERMINED BY LOW WATER MARK OF RIVER).

290 US 579, 54 S Ct 265-267 (1934).

Descriptors: *Low water mark, *Boundary disputes, *New Hampshire, *Vermont, Boundaries (Property), Judicial decisions, Legal aspects, Interstate, Water level fluctuations, Rivers, Droughts, Interstate rivers, State governments, Land tenure.

In an action to determine the boundary line between plaintiff state of Vermont and defendant state of New Hampshire, the Supreme Court of the United States decreed the boundary line to be the low water mark of a common, bordering river. The Court held that the low water mark was the point to which the river recedes at its lowest stage, without reference to, and unaffected by, extreme droughts, but subject to later changes effected by erosion or accretion. (Earl-Florida)
W71-03282

SINCLAIR REFINING CO V SMITH (LIABILITY FOR DECREASE IN CHANNEL DEPTH CAUSED BY NEGLIGENT DREDGING).
13 F2d 68-71 (5th Cir 1926).

Descriptors: *Dredging, *Shoals, *Channel improvement, *Navigable waters, Levees, Legal aspects, Judicial decisions, Channel flow, Navigation, Ships, Damages.

Defendants sought relief from a decree requiring them to dredge a channel to the depth existing before their earlier dredging operations, which had shoaled a previously navigable channel. Plaintiff riparian owner obtained the decree after materials which defendants had dredged from the channel escaped from a levee and prevented vessels from reaching plaintiff's shipyard. Defendants contended that concurrent dredging operations by the government required the plaintiff to establish what portion of shoaling resulted from the defendants' dredging. The court held that where shoaling is proximately and initially caused by dredging operations, it is no defense that concurrent dredging operations add to a decrease in channel depth. Noting the defendants were not responsible for future maintenance of the channel, the court ruled it proper to require the defendants to pay damages until the channel's navigability was restored. (Earl-Florida)
W71-03283

INDIAN REFINING CO V AMBRAW RIVER DRAINAGE DIST (INJUNCTION AGAINST MUNICIPALITY'S INTERFERENCE WITH RIPARIAN'S RIGHT TO UNDIMINISHED FLOW).
1 F Supp 937-942 (ED Ill 1932).

Descriptors: *Drainage districts, *Alteration of flow, *Illinois, *Riparian rights, Riparian water loss, Drainage effects, Relative rights, Riparian land, Local government, Prescriptive rights, Natural use, Right-of-way, Eminent domain, Drainage programs, Judicial decisions, Legal aspects, Water levels, Pumping, Remedies, Waste water disposal.
Identifiers: *Constitutionality, Injunction (Prohibitory).

Plaintiff riparian owner sought to enjoin defendant, a statutorily authorized municipal drainage district, from altering the course and level of a river. For a period exceeding twenty years plaintiff had withdrawn water for its refinery and had discharged waste water through downstream drains. Plaintiff contended that defendant's actions would lessen the efficiency of its pumps and create a reverse flow into its drains. Defendant asserted that plaintiff would have only consequential damages and thus no injunctive remedy. The federal district court held that a riparian owner vested with both natural and prescriptive rights may enjoin substantial alteration of water level by a municipal drainage district. Such action by a drainage district is not within the police powers of the state. The court decreed that: (1) ownership of land abutting a river is riparian and extends to the center thread of the stream; (2) easement and right-of-way ownership create riparian rights; (3) riparian rights may be acquired by prescription, and (4) riparian ownership includes the right of using water for proper incidental purposes and having stream flow uninterrupted by material diminution or alteration. Defendant's actions were enjoined on grounds that they would produce substantial damage to, and an unconstitutional taking of, plaintiff's riparian rights. (Earl-Florida)
W71-03284

NE-BO-SHONE ASS'N V HOGARTH (RIGHT OF GENERAL PUBLIC TO FISH IN NAVIGABLE RIVER).

7 F Supp 885-891 (WD Mich 1934).

Descriptors: *Public rights, *Ownership of beds, *Sport fishing, *Navigable rivers, Riverbeds, Beds, Beds under water, Rivers, Streams, Recreation demand, Obstruction to flow, Michigan, Access routes, Legal aspects, Judicial decisions, Land tenure, Navigation.

Plaintiff riparian owner sought to enjoin defendant state of Michigan's removal of obstacles which had been placed in a river to create a private fishing preserve. The river, not navigable by commercial vessels, was primarily a trout stream, but had been used for log flotation. Plaintiff averred his riparian ownership gave him the right to add to existing obstacles to prevent the passage of sport fishermen and boats. Defendant contended that the river's navigability created a public right to fish thereon. Finding the river navigable, the court held that under Michigan law a public trust exists on all navigable riverbeds. Therefore, a riparian owner has only co-equal fishing rights with the public and may not bar the public's waterborne access to such fishing. Recognizing the increasing need for recreational use of rivers, the court refused to enjoin the state's removal of obstacles in the river. The court defined a navigable river as one which in its natural state is capable of floating logs, boats, and rafts. (Earl-Florida)
W71-03285

NORFOLK AND W RY V MCCOY (RAILROAD'S FILL DIVERTS RIVER, ERODING FARMLAND).
250 Ky 190, 61 SW2d 1080-1082 (1933).

Descriptors: *Kentucky, *Diversion, *Damages, *Accelerated erosion, Erosion, Railroads, Alteration of flow, Flow around objects, Bank erosion, Adjudication procedure, Navigable rivers, Administrative agencies, Permits, River flow, Judicial decisions, Legal aspects, Remedies.

Plaintiff riparian farmowner sued defendant railroad for damages caused by diversion of a river. Plaintiff's farm was situated on the inside of a horseshoe bend in the river. Defendant filled in the river to construct a second track, and plaintiff contended that this fill diverted the river, causing erosion to his land. Defendant contended that since the fill was authorized by a War Department permit, plaintiff could not recover. However the court, in rejecting defendant's contention, observed that the permit expressly did not authorize injury to private property. Defendant also asserted that the damages awarded were excessive. In this context, the appellate court found that the farm had eroded only a few feet in six years. The court held that the $2000 jury verdict was excessive and reversed the lower court's decision. (Hart-Florida)
W71-03286

LAMB KNITTING MACH CO V CHICOPEE MFG CO (LITIGATION OVER AGREEMENT TO FURNISH WATER POWER).
273 Mass 506, 174 NE 130-135 (1930).

Descriptors: *Massachusetts, *Dams, *Water rights, *Contracts, Water conveyance, Water supply, Turnouts, Cofferdams, Dam construction, Diversion structures, Penstocks, Judicial decisions, Legal aspects, Canals, Competing uses, Relative rights, Power system operations.

Plaintiff machinery company sought to enjoin defendant manufacturing company from hindering its extraction of water from a canal for power purposes. In conveying land to defendant's predecessor, plaintiff's predecessor had reserved the right to water flowing through a 1 x 2 ft. hole at the surface of a canal, and the agreement was later modified to permit substitution of a 3 ft. penstock and raceway as the aperture. The penstock and raceway were later closed under the provisions of a further subsequent agreement. In the court below the master found that after the final agreement plaintiff had only the right to water passing through the original aperture. On appeal, plaintiff contended that the agreement had enlarged, not diminished, his rights. The appellate court held that the wording of the

agreement supported the master's contrary finding. Defendant was no longer required to maintain the discharge raceway for plaintiff. However, the court modified the decree to permit plaintiff to use a forced draft, and limited defendant's right to draw down the canal to reasonable times and means. (Hart-Florida)
W71-03287

VILLAGE OF ASHAROKEN V METROPOLITAN SAND AND GRAVEL CO (UPLAND OWNER HAS NO VESTED RIGHT TO FUTURE ACCRETIONS).
141 Misc 829, 253 NYS 294-298 (1931).

Descriptors: *Jetties, *New York, *Riparian rights, *Accretion (Legal aspects), Channel improvement, Navigable waters, Bays, Riparian land, Riparian waters, Natural flow doctrine, Obstruction to flow, Erosion, Bank erosion, Alteration of flow, Sands, Excavation, Channels, Cities, Shore protection, Coastal structures, Real property, Remedies, Legal aspects, Judicial decisions, Land tenure.

Plaintiff town brought action to restrain defendant sand and gravel company from erecting jetties and dredging a channel. Plaintiff contended that the jetties and channel in front of defendant's upland would interfere with the natural water flow, thereby preventing future accretion to plaintiff's adjacent upland and increasing the erosion of plaintiff's land. The court noted that the question of whether a riparian owner has a vested right to future accretion was one of first impression in any jurisdiction. Finding that the evidence disputed any increase in erosion resulting from the jetties or channel, the court held that future accretions are too speculative to create a vested right in the upland owner. Judgment was entered for defendant. (Liptak-Florida)
W71-03288

WALKER V UNITED STATES (VALIDITY OF TAX DEEDS TO OCEANFRONT PROPERTY).
428 F2d 1229-1233 (Ct Cl 1970).

Descriptors: *Taxes, *Beaches, *Land tenure, *Boundaries (Property), United States, Federal government, State governments, Florida, Assessments, Eminent domain, Condemnation, Legal aspects, Seashores, Riparian land, Shores, Coasts, Oceans, Judicial decisions, Adjudication procedure, Legislation.

Plaintiff brought action against the United States seeking compensation for beachfront property purchased for use in the space program. The United States had purchased the property from persons holding state tax deeds for plaintiff's nonpayment of taxes. Plaintiff contended that the tax deeds were invalid because the property had been used as a public beach and was, therefore, not assessible for taxes. Dismissing plaintiff's complaint, the court noted that the tax deeds specifically excluded the actual beach and that, if plaintiff's contention were true and the land were public beach, the state and not plaintiff would be the proper party to bring the action. (Liptak-Florida)
W71-03289

TEXAS EASTERN TRANS CORP V CITY OF INDIANAPOLIS (REGULATION OF PIPELINE TRAVERSING PUBLIC RESERVOIR).
262 NE2d 512-515 (Ind 1970).

Descriptors: *Indiana, *Pipelines, *Reservoirs, *Permits, Regulation, Flood damage, Local governments, Cities, Easements, Condemnation, Eminent domain, Flood control, Flood protection, Watershed protection, Public rights, Administrative decisions, Administrative agencies, Legal aspects, Judicial decisions.

Plaintiff oil company sought to recover damages from defendant city for interference with a pipeline easement. Plaintiff contended that the cost of laying and maintaining the pipeline had been greatly increased when defendant erected and filled a reservoir, thereby flooding portions of the pipeline. Defendant contended that plaintiff had failed to comply with the flood control commission's requirements for weighting the pipeline and for taking extra precautions against leakage. Affirming the flood control commission's denial of damages, the Supreme Court of Indiana noted that plaintiff's failure to take the required precautions was the cause of its extra expense. The court also noted that the flood control commission had the power, as a condition of plaintiff's pipeline permit, to require plaintiff to take such precautions at its own expense. Such pipeline easements are always subject to the public right to make needed improvements. (Liptak-Florida)
W71-03290

PEOPLE V GIBSON AND CUSHMAN OF NEW YORK (VALIDITY OF LOCAL DREDGING REGULATION IN NON-NAVIGABLE BAY).
314 NYS2d 476-479 (Dist Ct 1970).

Descriptors: *New York, *Permits, *Non-navigable waters, *Dredging, Bays, Regulation, Legislation, Cities, Local governments, State governments, Navigable waters, Beds, Ownership of beds, Sands, Legal aspects, Judicial decisions, Jurisdiction, Regulation.

Defendant was charged with violating a town ordinance prohibiting dredging the bed of a bay without a town permit. Defendant contended that the ordinance was unconstitutionally vague and that only the state, not the town, had the power to control dredging in the bay. The court noted that the standards contained in the ordinance were capable of reasonable application and, moreover, did not affect defendant even if they were vague since defendant had ignored the ordinance and dredged without applying for a permit. The court also held that the bay was not navigable as defined in those statutes vesting control of navigable waters in the state. Even if the water were navigable, the bed under such water was town property, which could be regulated and protected by the town. (Liptak-Florida)
W71-03291

IN RE VILLAGE OF LYNBROOK (VALUE OF LAND CONDEMNED FOR DRAINAGE EASEMENT WHERE OTHER EASEMENTS ALREADY EXIST).
314 NYS2d 404-409 (Sup Ct 1970).

Descriptors: *New York, *Condemnation value, *Easements, *Drainage systems, Condemnation, Eminent domain, Cities, Local governments, Drainage, Property values, Public rights, Public utilities, Parks, Legal aspects, Judicial decisions.
Identifiers: *Drainage easements.

In a county's proceeding to acquire drainage easements beneath land owned by a city, the city contended that the county had no power to acquire the easements by eminent domain. The city also argued that the land should be valued as though taken in fee, since existing easements had never been exercised. The county asserted its statutory authority to acquire drainage easements by condemnation and, as to the land's value, contended that the land was decreased in value by an existing public park easement, even though the land had not been used for park purposes and might never be so used. The court held, first, that the county did have eminent domain power to acquire the land and, second, that the park easement did diminish the land's value, but not to the extent claimed by the county. A decree based on the evidence was entered as to the value of the property. (Liptak-Florida)
W71-03292

FULTON FERRY AND BRIDGE CO V BLACK (LOCAL TOLL BRIDGE FRANCHISE PREEMPTED BY STATE HIGHWAY COMMISSION'S AUTHORITY).

293 SW 2-9 (Ark 1927).

Descriptors: *Arkansas, *Navigable rivers, *Permits, *Bridge construction, Bridges, State governments, Federal government, Rivers, Local governments, Contracts, Roads, Highways, Taxes, Legal aspects, Judicial decisions, Legislation, Administrative agencies, State jurisdiction, Supervisory control (Power).

Plaintiff bridge company sued to enjoin defendant state highway commissioner from building a toll bridge across a navigable river dividing two counties. The county courts of both counties, under their exclusive jurisdiction over roads and bridges, had granted plaintiff a franchise to build the bridge. While plaintiff was seeking the consent of Congress to build the bridge, the state legislature authorized defendant to build the bridge, and Congress gave its consent. Plaintiff contended that the legislature's action was unconstitutional because it invaded the county courts' jurisdiction and impaired the contract rights arising from the franchise. The court held that the county courts' jurisdiction was not violated unless the bridge involved a general tax on the people or required county funds and noted that a toll bridge is not a general tax, but only a tax on those who use the bridge. The court also held that plaintiff's contract was not binding for lack of mutuality since the consent of Congress was a condition precedent to the vesting of any contract rights. (Liptak-Florida)
W71-03293

THE MERCURY POLLUTION PROBLEM IN MICHIGAN AND THE LOWER GREAT LAKES AREA (A SUMMARY OF INFORMATION AND ACTION PROGRAMS),
Michigan Water Resources Commission, Lansing.
For primary bibliographic entry see Field 05G.
W71-03294

THE NATIONAL WATER COMMISSION, ANNUAL REPORT FOR 1969: INTERIM REPORT NO 1.
National Water Commission, Arlington, Va.
For primary bibliographic entry see Field 06B.
W71-03295

STATE DISPOSITION OF SUBMERGED LANDS VERSUS PUBLIC RIGHTS IN NAVIGABLE WATERS,
David G. Nelson.
Natural Resources Law, Vol 5, p 491-511, 1970. 21 p, 101 ref.

Descriptors: *Ownership of beds, *Beds under water, *Public rights, *State governments, Riparian rights, Governments, Legal aspects, Judicial decisions, Navigable waters, Estuaries, Damages, Dredging, Landfills, Disposal, Land management, Navigation, Remedies, Federal government, Administrative agencies.

Public interest in submerged lands under navigable waters is of increasing importance today. Discussed herein is a study of legal and political theories for the prevention of the indiscriminate disposal of submerged lands by state governments. A state may convey submerged lands subject to: (1) vested private rights; (2) the navigational power of the federal government; and (3) the rights of the public in the lands and waters remaining within the state. Standing to enforce violations of public rights is also examined. Standing is found when the injury to the individual is different in nature from the injury to the public in general. Federal administrative agencies may often have standing to enforce their paramount rights in navigable waters even though individual rights might not prevail. In spite of legal safeguards, it is concluded that the disposition of submerged lands is subject to the arbitrary and absolute control of state legislatures, subject only to

vested public rights and the paramount federal interest. (Barnett,Florida)
W71-03296

UNITED STATES PROPRIETARY CLAIM TO THE CONTINENTAL SHELF GIVES RISE TO A NEW PUBLIC DOMAIN,
Gregory M. Lattimer.
Land and Water Law Review, Vol 5, p 509-516, 1970.

Descriptors: *Judicial decisions, *Continental shelf, *Federal jurisdiction, *Reefs, Legislation, Tidal waters, Submerged Lands Act, Islands, Beds, Beds under water, Ownership of beds, Land tenure, Legal aspects, United States.

Entrepreneurs, planning to construct an ocean resort complex on a partially submerged reef five miles off the Florida coast, applied for a dredging permit from the Secretary of the Army. Despite denial of the permit, dredging was commenced, and the United States filed suit to enjoin further activity. Defendants contended that the project was outside the United States' territoral jurisdiction. The United States district court held that the reefs were not islands, but seabed, and subject to United States jurisdiction. In examining the ramifications of this decision, United States v Ray, 281 F. Supp. 876 (S.D. Fla. 1965), the author discusses the legal development of the Continental Shelf, dividing it into three zones: territorial waters, high seas, and contiguous waters. 'Seabed' is classified according to three international theories: (1) the view that the seabed is the common property of all nations; (2) the view that the seabed is land presently unappropriated but capable of acquisition; and (3) a combination of these two, classifying seabed as common property and subsoil as capable of acquisition. The author contends that this decision is the beginning of a phase in which the United States will assert plenary control and jurisdiction over the Continental Shelf; this decision is the catalyst for establishment of sovereign rights in the Continental Shelf by the United States. (Hart-Florida)
W71-03297

ESTUARINE CONSERVATION LEGISLATION IN THE STATES (AN EXAMINATION OF SOME EXISTING LEGISLATION AND SOME PROPOSALS),
Milton S. Heath, Jr.
Land and Water Law Review, Vol 5, p 351-390, 1970. 40 p, 65 ref.

Descriptors: *Estuaries, *Conservation, *Legislation, *State governments, Adoption of practices, Grassed waterways, Bays, Estuarine environment, Estuarine fisheries, Inlets (Waterways), Intertidal areas, Saline water-fresh water interfaces, Federal project policy, Water resources development, Legal aspects.

Population growth and consequent pollution have endangered the nation's estuaries, requiring a conservation program. Federal studies have concluded that the states must be the focal point for action to conserve the estuaries. Planning programs and regulations have been adopted in some coastal states. The author discusses the experiences of those states which have begun conservation programs and provides a detailed description of several particularly successful state programs. Statutes proposed for adoption are: (1) an act providing for a comprehensive study of state estuaries, (2) an act providing for permits to dredge or fill in or about estuarine waters, and (3) an act providing for regulation of estuarine dredging and filling by rule-making authority. The purpose and effects of the various statutory proposals are delineated. (Hart-Florida)
W71-03298

PROPOSED SYSTEMS OF COASTAL ZONES MANAGEMENT: AN INTERIM ANALYSIS,
For primary bibliographic entry see Field 02L.
W71-03299

A CAPSULE HISTORY AND THE PRESENT STATUS OF THE TIDELANDS CONTROVERSY,
Austin W. Lewis.
Natural Resources Lawyer, Vol 3, p 620-636, 1970. 16 p, 48 ref.

Descriptors: *Tidal waters, *Leases, *Oil, *Federal-state water rights conflicts, Federal jurisdiction, State jurisdiction, Reservation doctrine, Continental shelf, Submerged Lands Act, Accretion (Legal aspects), Oil wells, Oil fields, Natural gas, Exploration, Mineral industry, Legal aspects, Judicial decisions, Legislation.

The controversy between the federal government and the coastal states over the right to control the tidelands has lasted since 1937. Although the states were originally considered the legal owners of the tidelands, judicial decisions established in the federal government a paramount right, superior to the states' ownership, to control these navigable waters. Various congressional acts partially restored state control over the tidelands, but these acts themselves brought more litigation, primarily over the line on the coast from which state jurisdiction was to be measured. The continuing controversy has resulted in an ambulatory line dividing state-federal jurisdiction, causing split leases of mineral rights, two sets of regulations governing mineral and oil fields, and stringent environmental policy regulations in juxtaposition to extremely lenient or non-existent environmental policies. The overall result is a stifling of oil and gas exploration in the coastal areas. (Hart-Florida)
W71-03300

6F. Nonstructural Alternatives

SPECIAL FLOOD PLAIN INFORMATION STUDY, LUXAPALILA CREEK - TOMBIGBEE RIVER AND TRIBUTARIES, MISSISSIPPI AND ALABAMA.
Corps of Engineers, Mobile, Ala.
For primary bibliographic entry see Field 04A.
W71-02763

FLOOD PLAIN INFORMATION OF LOWER RIVER ROUGE, WAYNE MICHIGAN AND VICINITY.
Corps of Engineers, Detroit, Mich.
For primary bibliographic entry see Field 04A.
W71-02764

FLOOD PLAIN INFORMATION - LEMON CREEK AT JUNEAU, ALASKA.
Corps of Engineers, Juneau, Alaska.
For primary bibliographic entry see Field 04A.
W71-02765

FLOOD PLAIN INFORMATION OF BIG WOOD RIVER, KETCHUM, IDAHO AND VICINITY.
Corps of Engineers, Walla Walla, Wash.
For primary bibliographic entry see Field 04A.
W71-02928

FLOOD PLAIN INFORMATION, MENDENHALL RIVER, JUNEAU, ALASKA.
Corps of Engineers. Alaska District.
For primary bibliographic entry see Field 04A.
W71-03134

THE NATIONAL WATER COMMISSION, ANNUAL REPORT FOR 1969: INTERIM REPORT NO 1.
National Water Commission, Arlington, Va.
For primary bibliographic entry see Field 06B.
W71-03295

6G. Ecologic Impact of Water Development

SOME CHARACTERISTICS OF THE OPERATIONAL RESERVOIRS IN THE ISRAEL NATIONAL WATER SYSTEM,
For primary bibliographic entry see Field 02H.
W71-02871

LITTORAL ENVIRONMENT OBSERVATION PROGRAM IN CALIFORNIA, PRELIMINARY REPORT FEBRUARY-DECEMBER 1968,
Army Coastal Engineering Research Center, Washington, D.C.
For primary bibliographic entry see Field 02L.
W71-03088

ESTUARINE CONSERVATION LEGISLATION IN THE STATES (AN EXAMINATION OF SOME EXISTING LEGISLATION AND SOME PROPOSALS),
For primary bibliographic entry see Field 06E.
W71-03298

07. RESOURCES DATA

7A. Network Design

PROBLEMS OF EVALUATION OF SOIL MOISTURE FOR WATER BALANCES ON LARGE AREAS,
Technical Univ. of Prague (Czechoslovakia). Soil Science Lab.
For primary bibliographic entry see Field 02G.
W71-02766

REVISION OF THE GAGING STATIONS IN UPPER CEYHAN BASIN, TURKEY,
Electric Power Investigations, Ankara (Turkey). Hydrometric Section.
For primary bibliographic entry see Field 02E.
W71-02814

MINIMAL DATA GATHERING PROCEDURE,
West Pakistan Water and Power Development Authority, Lahore.
R. F. Stoner.
In: Proceedings of Central Treaty Organization Seminar on Evaluation of Water Resources With Scarce Data, March 4-8, 1969, Tehran, Iran, p 103-115, January 1970. 13 p, 2 fig, 1 tab, 5 ref.

Descriptors: *Water resources, *Data processing, *Statistics, *Foreign projects, Equations, Water resources development.
Identifiers: *West Pakistan, Scarce data.

This paper is concerned with the problem of establishing the minimum amount of water resources data that we can reasonably collect to achieve a defined degree of precision in the end result. Statistical procedures are used throughout, but the presentation deliberately avoids the use of difficult mathematics. While professional statisticians would qualify many of the statements, there are, nevertheless, some broad truths stated and it is hoped that those connected with simple sampling, to whom statistics is a mystery, will be able to appreciate the concepts involved and the procedures for determining the minimum number of samples necessary. These were encountered during the Lower Indus Project investigations which were directed towards formulating an optimum plan for the development of land and water resources in the former Sind area of West Pakistan, an area of approximately 14 million acres. (Woodard-USGS)
W71-02823

HYDROLOGY OF SURFACE WATER IN IRAN,
Ministry of Water and Power, Tehran (Iran). Dept. of Hydrology.
M. Ghazi-Nouri.
In: Proceedings of Central Treaty Organization Seminar on Evaluation of Water Resources With Scarce Data, March 4-8, 1969, Tehran, Iran, p 17-27, January 1970. 11 p, 2 fig, 2 tab.

Descriptors: *Water resources, *Water resources development, *Surface waters, *Programs, *Planning, Precipitation (Atmospheric), Watershed management, Evaporation, Runoff, Sediments, Foreign projects, Data collections, Network design, Gaging stations, Hydrologic data.
Identifiers: *Iran, Scarce data.

Procedures are described for collecting and publishing data for river discharge, sediment transport, precipitation and evaporation in the hydrologic network of Iran. Within the twenty years of existence, the Surface Water Department of Iran has achieved great success and the collected data have been successfully used in various development projects throughout the country. Plans for future programs are described. The 1,642,000 sq km area of Iran requires that the hydrologic network be increased, particularly in the central and eastern parts where water deficiency is critical. Future programs of the Surface Water Dept proposed for the fourth Five Year plan include the following new stations: river gaging, 250 staff gages and 100 water level recorders; 100 cableways; rain gages, 70 recording, 350 storage, 300 ordinary; 50 snow course rods; and 70 evaporation stations. For the Meteorological Dept, 500 rain gages and 120 climatological stations are proposed. Also 150 reference stations, 50 agri-climatological and 6 micro-climatological stations are programmed. (Lang-USGS)
W71-02912

HYDROLOGICAL AND RELATED DATA PROGRAMS IN THE UNITED STATES OF AMERICA,
Geological Survey, Washington, D.C.
Raymond L. Nace.
In: Proceedings of Central Treaty Organization Seminar on Evaluation of Water Resources With Scarce Data, March 4-8, 1969, Tehran, Iran, p 87-101, January 1970. 15 p, 1 tab, 31 ref.

Descriptors: *Water resources, *Hydrologic data, *Programs, *United States, Surface waters, Groundwater, Streamflow, Runoff, Water table, Dissolved solids, Suspended load, Meteorological data, Network design, Instrumentation, Automation, Remote sensing, Watershed management.
Identifiers: Radiometric data, Hydrological tracers.

About 30 Federal agencies in the United States have sufficient concern with water to collect or pay for the collection of basic data. Most of these agencies obtain data for their own use in their own specific missions, and they do not routinely make data available to others directly or through publication. Two agencies, the Environmental Data Service and the Geological Survey, have primary missions to collect, analyze, interpret and publish data as a public service. It is not feasible to summarize the many kinds of data that are being collected in relation to specific practical problems. Two examples are cited. Soil conservation, erosion control, and watershed management in general are important problems in the United States. The Agricultural Research Service of the U. S. Department of Agriculture has selected 270 experimental watersheds as a sample of the land resources area of the United States. Another significant example of watershed research is that by the U. S. Forest Service in about 250 watersheds dispersed throughout the Nation. Topics reviewed include National Data Coordination, Regional Data Centers, Data Networks and Records, Long-Term Records, Short-Term Records, Network Design, Instruments and Methods, Automation, Remote Sensing, Hydrological Tracers, Geophysical Technology, and conclusions. Hydrological and related data collection networks in the United States are tabulated. (Woodard-USGS)
W71-02918

EVALUATION OF THE STREAMFLOW-DATA PROGRAM IN OREGON,
Geological Survey, Portland, Oreg.
David J. Lystrom.
Geological Survey Open-file Report, 1970. 28 p, 3 fig, 2 plate, 2 tab, 18 ref, append.

Descriptors: *Streamflow, *Evaluation, *Oregon, *Data collections, Planning, Hydrologic data, Precipitation (Atmospheric), Runoff, Gaging stations, Peak discharge, Surface waters, Reservoirs, Rivers, Natural flow, Regulated flow, Regression analysis, Environmental effects, Stream gages.
Identifiers: *Streamflow data (Oreg).

Streamflow data available from 307 gaging stations in Oregon are evaluated and guidelines for planning future programs are provided. Basic steps in the evaluation procedure are (1) definition of the long-term goals of the stream-data program in quantitative form, (2) examination and analysis of all available data to determine which goals have been achieved, and (3) consideration of alternative programs and techniques to meet remaining objectives. Only a few of the goals can be met by generalization of the data now available for gaged basins. Recommendations are made to improve the generalization methods, and deficiencies in the present network are pointed out. Based on the needs described, a new streamflow-data program is proposed. (Woodard-USGS)
W71-02925

A PROPOSED STREAMFLOW DATA PROGRAM FOR WISCONSIN,
Geological Survey, Madison, Wis.
Roy E. Campbell, and Frederick C. Dreher.
Geological Survey Open-file Report, 1970. 55 p, 10 fig, 3 tab, 7 ref, append.

Descriptors: *Streamflow, *Evaluation, *Wisconsin, *Data collections, *Planning, Hydrologic data, Precipitation (Atmospheric), Runoff, Gaging stations, Stream gages, Peak discharge, Rivers, River basins, Natural flow, Regulated flow, Regression analysis, Environmental effects.
Identifiers: *Streamflow data (Wis).

An evaluation of streamflow data from 197 gaging stations in Wisconsin and adjacent areas was made to provide guidelines for planning programs. The basic steps in the evaluation procedure were (1) definition of the long-term goals of the streamflow data program, (2) examination and analysis of all available data to determine which goals have already been met, and (3) consideration of alternate programs and techniques to meet the remaining objectives. Streamflow data were classified according to the type of use or purpose. Recommendations were made as to whether a station should be included in the network or whether it had net the objective for which it was operated and could be discontinued. Recommendations were made as to expanding or initiating studies. Streamflow data collection should be a continuing effort, reoriented as necessary to meet the changing needs. (Woodard-USGS)
W71-02926

POLLUTION SURVEILLANCE AND DATA ACQUISITION USING MULTISPECTRAL REMOTE SENSING,
Michigan Univ., Ann Arbor. Dept. of Environmental Health.
For primary bibliographic entry see Field 05A.
W71-03127

7B. Data Acquisition

ON THE QUESTIONS OF RAINFALL MEASUREMENT AND REPRESENTATIVENESS,
Hydrological Research Unit, Wallingford (England).
For primary bibliographic entry see Field 02B.
W71-02777

ESTIMATING THE VOLUME OF AN AQUIFER BY USING CHLORIDE TRACER,
State Hydraulic Works, Ankara (Turkey). Dept. of Research.
For primary bibliographic entry see Field 02F.
W71-02810

WATER BALANCE OF NATURAL UNDERGROUND STORAGE,
Water Research Association, Medmenham (England). Hydrology Div.
For primary bibliographic entry see Field 02F.
W71-02811

A SENSITIVE CUP-TYPE ANEMOMETER,
Washington Univ., Seattle.
Leo J. Fritschen.
Funded in part by the Atmospheric Science Research Division, U. S. Army Electronic and Development Activity, Fort Huachuca, Arizona.
Journal of Applied Meteorology, Vol 6, No 4, August 1967, p 695-698. 4 fig, 1 tab, 8 ref.

Descriptors: *Anemometers, *Research equipment, *Arid lands, *Instrumentation, *Wind velocity, Meteorology, Evaporation, Agriculture, Hydrology, Design, Calibrations, Surfaces.
Identifiers: *Crop surface, *Wind-speed profile.

Wind-speed measurements are important to agricultural, evaporation, hydrological and meteorological research, particularly in arid lands. The sensitive cup-type anemometer described here was designed to measure wind-speed profiles over crop surfaces of limited extent. The simple design uses commercial parts where possible and few electronic components to facilitate rapid dismantling for cleaning. Three 7.6-cm right angle plastic cone cups are mounted at a 7.8-cm arm length. A sensitive relay to interrupting light on a photoconductive cell determines wind speed. Response characteristics are an initial speed of 6 cm per sec, a distance constant of 90 cm, and a linear response over the velocity range tested. Figures include a photograph of the assembly, a sectional diagram of the anemometer transmitter, the anemometer counting circuit, and linear calibration results of cup assemblies. The table of anemometer characteristics show seven features for five cup assemblies. (Popkin-Arizona)
W71-02864

ANNOTATED BIBLIOGRAPHY OF REPORTS, STUDIES, AND INVESTIGATIONS RELATING TO SATELLITE HYDROLOGY,
National Environmental Satellite Center, Washington, D.C.
For primary bibliographic entry see Field 02A.
W71-02955

FAO/UNESCO/WMO AGROCLIMATOLOGY SURVEY OF A SEMI-ARID AREA IN WEST AFRICA SOUTH OF THE SAHARA,
Food and Agriculture Organization of the United Nations, Rome (Italy). Land and Water Development Div.
For primary bibliographic entry see Field 02B.
W71-02972

ACETYLENE REDUCTION ASSAY FOR DETERMINATION OF PHOSPHORUS AVAILABILITY IN WISCONSIN LAKES,
Wisconsin Univ., Madison. Dept. of Biochemistry.
W. D. P. Stewart, G. P. Fitzgerald, and R. H. Burris.

National Academy of Sciences, Vol 66, No 4, p 1104-1111, 1970. 2 fig, 8 tab, 17 ref.

Descriptors: *Assay, *Phosphorus, *Wisconsin, *Lakes, Aquatic environment, Surfaces, Diurnal, Thermocline, Storm drains, Eutrophication, Sampling, Cyanophyta, Sulfur, Iron, Magnesium, Photosynthesis, Phosphates.
Identifiers: *Acetylene reduction, Anabaena flos-aquae, Lake Mendota (Wis), Lake Monona (Wis), Lake Wingra (Wis).

Phosphorus-starved cells of Anabaena flos-aquae rapidly increase their capacity to reduce acetylene to ethylene when phosphorus becomes available. This response can be utilized as a bioassay for detecting available phosphorus in aquatic ecosystems. The same standard curve is applicable to all waters tested using the same batch of assay organisms. The sensitivity of the method compares favorably with conventional methods for measuring dissolved orthophosphate, and has the additional advantage that it measures available phosphorus. A failure to detect acetylene reduction in test water samples with added phosphorus is due to some inhibitory factor in the water. The test would not be conclusive in the presence of total inhibitors. The quantitative determination of the amount of available phosphorus in a particular water is more complex. Studies of Wisconsin lakes show that available phosphorus generally is present, that the concentrations are higher at the lower depths than at the surface, and that there may be diurnal variations in the available phosphorus content of surface waters. Important sources of available phosphorus in Lake Mendota are the waters below the thermocline and the input from storm sewers. Biological nitrogen fixation can also be studied with similar equipment. (Jones-Wisconsin)
W71-03024

RAPIDLY LABELED POLYPHOSPHATES AND METAPHOSPHATES IN THE BLUE-GREEN ALGA ANACYSTIS NIDULANS (IN GERMAN),
Technische Hochschule, Hanover (West Germany). Inst. for Botany.
R. Niemeyer, and G. Richter.
English summary. Archiv fur Mikrobiologie, Vol 69, p 54-59, 1969. 3 fig, 10 ref.

Descriptors: *Analytical techniques, *Phosphates, *Algae, Chromotography, Radiochemical analysis, Tracers.
Identifiers: *Anacystis nidulans, Oligophosphates, Metaphosphates, Pulse-labeling, Polyphosphates, Fractionation.

The cells of the blue-green alga Anacystis nidulans were pulse-labeled with phosphorus-32-orthophosphate and grown for 20 hours in phosphorus-free medium. Most of the phosphorus-32 was incorporated into inorganic phosphates which were isolated by joining extraction with the nucleic acid and fractionation on methylated serum albumin and Kieselgur. The column chromtography of the isolate revealed 8 phosphate residues including oligophosphates and circular metaphosphates of thus far unknown origin and function. The trimetaphosphate incorporated considerably more radioactivity than other low-molecular inorganic phosphates. (Wilde-Wisconsin)
W71-03033

SIMULATING THE EFFECT OF SINKING AND VERTICAL MIXING ON ALGAL POPULATION DYNAMICS,
Oregon State Univ., Corvallis. Dept. of Civil Engineering.
For primary bibliographic entry see Field 05C.
W71-03034

AUTOMATIC RAPID METHOD FOR DETERMINATION OF CARBON AND HYDROGEN (IN GERMAN),
Wolfgang Merz.
English summary. Analytica Chimica Acta, Vol 48, p 381-390, 1969. 7 fig, 1 tab, 10 ref.

Descriptors: *Carbon, *Hydrogen, *Analytical techniques, Organic matter, Oxidation, Titration, Automation.
Identifiers: Carbon monoxide, Carbon dioxide.

The sample of organic matter is burned with manganese dioxide in a stream of oxygen. Combustion products are completely oxidized over copper oxide. The apparatus is flushed with nitrogen, water is frozen out, and carbon dioxide is absorbed in a cell containing an amine in dimethylformamide. The carbon dioxide is titrated with tributylmethylammonium hydroxide. Water is vaporized in a stream of nitrogen and passed over carbon at 1170C. The formed carbon monoxide is oxidized with copper oxide and carbon dioxide is titrated as described. The procedure is entirely automatic and the analysis time for both carbon and hydrogen is 8 minutes. (Wilde-Wisconsin)
W71-03036

ESTIMATES OF SESTON CROPS BY FILTRATION WITH GLASS FIBER DISCS,
Colorado Dept. of Game, Fish and Parks, Glenwood Springs; and Colorado State Univ., Fort Collins. Dept. of Zoology.
For primary bibliographic entry see Field 02H.
W71-03051

A SUCTION PIPE FOR SAMPLING MIDWATER AND BOTTOM ORGANISMS IN THE SEA,
SACLANT ASW Research Centre, La Spezia (Italy).
Norberto Della Croce, and Anselmo Chiarabini.
Available from NTIS as AD-854 841, $3.00 in paper copy, $0.95 in microfiche. NATO Technical Memorandum No. 143, May 15, 1969. 13 p.
Identifiers: *Oceanographic equipment, *Samplers, *Acquatic animals, Samplers, *Plankton, Samplers, Surface properties, Sea water, Efficiency, Depth finding, Sedimentation, Underwater sound, Scattering, Pipes, Microorganisms, Compressed air, Ocean bottom, Mediteranean Sea, Ligurian Sea, *Suction pipes.

A suction pipe for sampling mid-water and bottom organisms in the Sea is described. The device can be used from a stationary ship for taking samples at water depths greater than 100 m. If used at the bottom from 25 kg to 50 kg of sediment can be collected in ten minutes, suggesting that the equipment is suitable for quantitative research.
W71-03080

SIMPLE INSTRUMENTATION FOR MEASURING TEMPERATURE GRADIENTS AT THE SEA-AIR INTERFACE, INCLUDING THE RESULTS OF WINTER 1964/65 MEASUREMENTS,
SACLANT ASW Research Centre, La Spezia (Italy).
Allen H. Schooley.
Available from NTIS as AD-472 612, $3.00 in paper copy, $0.95 in microfiche. NATO Technical Report No. 35, July 1965. 24 p.
Identifiers: *Ocean waves, Surface temperatures, *Temperature sensitive elements, Atmospheric temperature, Oceanographic data, Oceans, Instrumentation, Measurement, Heat transfer, Solar Sea water, Italy, Ligurian Sea, Air water interactions, Temperature gradients.

Very little information available on the temperature differates in the first several centimeters of air above the sea surface and the first few centimeters of water below the sea surface. Data of this kind are important in helping to understand heat exchange between the sea and the atmosphere. They may also be a significant factor in the phenomena of sonar surface-reverberation. A series of measurements is now underway to determine the magnitude and fluctuations of these temperate gradients during hourly, daily, and special intervals. These are being made in the open sea off the Ligurian Coast of Italy. The gradients are measured with respect to the actual undulating surface of the sea. The instrumentation being used is described.
W71-03081

AN ECHO INTEGRATOR FOR USE IN THE ESTIMATION OF FISH POPULATIONS,
Washington Univ., Seattle. Fisheries Research Inst.
Henry Wayne Lahore, and Dean W. Lytle.
Available from NTIS as PB-190 367, $3.00 in paper copy, $0.95 in microfiche. Circular No. 70-1, January 26, 1970. 38 p.

Descriptors: Washington.
Identifiers: Fish surveys, Echo integrators, Test fishing, *Fishes, Counting methods, *Echo ranging, Fishes, Population, Abundance, Detectors, Accuracy, Underwater sound, ULTRASONIC RADIATION, Management planning, Efficiency, Theses.

The echo integrator is a sonic device that enables the fishery researcher to quantity fish stocks more accurately than he has been able to do by the use of test fishing and/or an unmodified echo sounder. In this report the fundamentals of underwater acoustics are discussed, the echo integrator is described, and its operation and performance in field experiments are treated.
W71-03083

APPLICATIONS OF ENVIRONMENTAL SATELLITE DATA TO OCEANOGRAPHY AND HYDROLOGY,
National Environmental Satellite Center, Washington, D.C.
E. Paul McClain.
Available from NTIS as PB-190 652, $3.00 in paper copy, $0.95 in microfiche. ESSA Technical Memorandum NFSC7M 19, January 1970. 13 p.
Identifiers: *Meteorological satellites, Infrared radiation, *Sea water, Surface temperatures, *Sea ice, Surface temperatures, Infrared photography, Ocean waves, Snow, Wind, Clouds, Weather forecasting, Multiband special reconnaissance, Radiometers, Sea state, Air water interactions, TIROS, Nimbus D Satellite, ATS satellites, Remote sensing.

A research group within the National Environmental Satellite Center is helping to develop applications of environmental satellite data to problems in oceanography and hydrology. Techniques for large-scale mapping of sea surface temperatures in clear and partly cloudy regions are being developed with the aid of high-resolution inflared (HRIR) data from NASA's Nimbus satellites. Digitized television pictures from the ESSA operational satellites and NASA's Application Technology Satellites (ATS) are being studied in conjunction with the relation between sunglint patterns and the ocean wave spectrum and low-level wind stress. New methods for the mapping of major snow and ice boundaries from satellite altitude have been devised and are being tested. The NESC is also involved cooperatively with several Government agencies and NASA in research and applications development in conjunction with the first Earth Resources Technology Satellites.
W71-03085

DETERMINATION OF MERCURY IN WATER,
Geological Survey, Denver, Colo.
For primary bibliographic entry see Field 05A.
W71-03114

MEASURING FOREST EVAPOTRANSPIRATION - THEORY AND PROBLEMS,
Forest Service (USDA), Durham, N.H. Northeastern Forest Experiment Station.
For primary bibliographic entry see Field 02D.
W71-03122

SOIL HYDRAULIC CONDUCTIVITY MEASUREMENT BY FIELD MONOLITHS,
Ohio Agricultural Research and Development Center, Wooster.
For primary bibliographic entry see Field 02G.
W71-03142

7C. Evaluation, Processing and Publication

WATER RESOURCES DATA FOR TEXAS, 1968 - PART 2. WATER QUALITY RECORDS.
Geological Survey, Austin, Tex. Water Resources Div.
For primary bibliographic entry see Field 02K.
W71-02759

A METHOD FOR RUNOFF-MAPPING FROM PRECIPITATION AND AIR TEMPERATURE DATA,
For primary bibliographic entry see Field 02A.
W71-02767

ESTIMATING THE FREQUENCY DISTRIBUTION OF HYDROLOGIC RESIDENCE TIMES,
Commonwealth Scientific and Industrial Research Organization, Canberra (Australia). Div. of Land Research.
For primary bibliographic entry see Field 04A.
W71-02770

ESTIMATION AND MAPPING OF EVAPORATION,
British Meteorological Office, Bracknell (England).
For primary bibliographic entry see Field 02D.
W71-02774

DATA FOR THE STUDY OF THE WATER BALANCE IN SPAIN (IN FRENCH),
Rafael Heras.
English, Spanish, and Russian abstracts. In: Symposium on World Water Balance, Vol 2, International Association of Scientific Hydrology Publication No 93, p 332-342, July 1970. 11 p, 3 fig, 1 tab, 4 ref.

Descriptors: *Water balance, *Hydrologic data, *Foreign projects, Synoptic analysis, Reviews, Hydrologic cycle, Hydrologic budget, International Hydrological Decade, Meteorology, Precipitation (Atmospheric), Surface waters, Groundwater, Evapotranspiration, Runoff, Streamflow, Water storage.
Identifiers: *Spain.

Methods of utilizing hydrologic data to evaluate water balance in ten hydrographic basins of Spain are presented. Results can be considered as very representative in connection with rainfall, surface flows, regulated volumes, demands, evapotranspiration, and underground waters. Through the comparison of resources and demands, the water balance is established (with reference to the year 1967) to the year 2000. (Woodard-USGS)
W71-02791

SURFACE WATER EVALUATION WITH LIMITED DATA IN THE ARID REGION OF WEST PAKISTAN,
Pakistan Planning Commission, Rawalpindi. Water and Power Div.
For primary bibliographic entry see Field 02E.
W71-02800

A NOTE CONCERNING THE IMPROVEMENT OF THE MEAN ANNUAL RUNOFF MAP OF TURKEY,
Huseyin Conturk.
In: Proceedings of Central Treaty Organization Seminar on Evaluation of Water Resources With Scarce Data, March 4-8, 1969, Tehran, Iran, p 407-411, January 1970. 5 p, 17 ref.

Descriptors: *Water resources, *Runoff, *Average flow, *Foreign projects, Precipitation (Atmospheric), Water loss, Water levels, Climatic data.
Identifiers: *Turkey, *Runoff map improvement.

Recently a map of mean annual runoff in Turkey has been published (Conturk and Bayar, 1968). Runoff is presented by isolines in milimeters. To construct the isolines, records of some 450 stream gaging stations having at least one year service life were utilized. Results were adjusted to the basic period 1936-65. (Isenlohr, 1962). No corrections were made, however, for irrigation water losses and other major water losses. In other words, the map represents discharges as they are measured. A number of difficulties were encountered during the development of the map due to limitation of existing data as regards both space and time. Difficulties were smoothed over mostly by subjective handling. Accordingly, the map is approximate and needs improvement. Possible ways of improving annual runoff values in Turkey are defined in this report under the following sub-headings: (a) Estimation of runoff from precipitation; (b) Runoff from precipitation and water losses; (c) Runoff from water levels; (d) Runoff from climatologic and basin characteristics; (e) Runoff from runoff; and (f) Precipitation as an additional variable. (Woodard-USGS)
W71-02805

FREQUENCY ANALYSIS OF RIVER STAGE DATA IN EAST PAKISTAN,
East Pakistan Water and Power Development Authority, Dacca.
For primary bibliographic entry see Field 02E.
W71-02807

ZONES AS TO ANNUAL STREAMFLOW VARIATION IN TURKEY,
Electric Power Investigations, Ankara (Turkey). Hydrometric Section.
For primary bibliographic entry see Field 02E.
W71-02815

RAINFALL FREQUENCY ATLAS OF TURKEY,
State Hydraulics Works, Ankara (Turkey). Hydrology Section.
For primary bibliographic entry see Field 02B.
W71-02820

DROUGHT FREQUENCY ANALYSIS BY MEANS OF SYNTHETIC FLOW SEQUENCES,
State Hydraulic Works, Ankara (Turkey). Hydrology Section.
For primary bibliographic entry see Field 02E.
W71-02821

EVALUATION OF WATER RESOURCES WITH SCARCE DATA.
Central Treaty Organization.
For primary bibliographic entry see Field 02A.
W71-02824

SLAB BRIDGE DESIGN AND DRAWING--AN AUTOMATED PROCESS,
Atkins (W. S.) and Partners.
For primary bibliographic entry see Field 08A.
W71-02854

COUNTRY REPORT FOR TURKEY,
Water Operations and Hydrology Lab., Ankara (Turkey).
Korkut Ozal.
In: Proceedings of Central Treaty Organization Seminar on Evaluation of Water Resources With Scarce Data, March 4-8, 1969, Tehran, Iran, p 33-36, January 1970. 4 p, 3 fig, 1 tab.

Descriptors: *Water resources, *Hydrologic data, *Foreign projects, Streamflow, Gaging stations, Precipitation (Atmospheric), Evaporation, Temperature, Solar radiation, Humidity, Atmospheric pressure, Wind velocity, Sediments, Watershed management, Lakes, Water balance, Rainfall-Runoff relationships.
Identifiers: *Turkey, Scarce data.

Tables and maps show the types and location of stations and the agencies that are involved in the collection of hydrological and meteorological data in Turkey. Included is a list of the main hydrological publications published in Turkey since the previous CENTO Symposium on Hydrology held in 1966. General statistics concerning the water balance are given. Total runoff is estimated to be 160 milliards cubic meters. In addition, between 6 and 8 milliards cubic meters of groundwater is in storage. Average annual rainfall over the country is about 670 mm, but varies between 160 and 2,500 mm. The data collection network is considered adequate in number of stations but improvement in quality is needed. Three maps, scaled 100 km per in, show (1) runoff in liters per sec per sq km, (2) location of hydrometeorological stations operating and planned, and (3) location of streamflow measuring stations and lake observations in 1966, 1967, and 1968. (Lang-USGS)
W71-02914

MAXIMUM UTILIZATION OF SCARCE DATA IN HYDROLOGIC DESIGN,
Corps of Engineers, Sacramento, Calif. Hydrologic Engineering Center.
Leo R. Beard, and A. J. Frederick.
In: Proceedings of Central Treaty Organization Seminar on Evaluation of Water Resources With Scarce Data, March 4-8, 1969, Tehran, Iran, p 129-137, January 1970. 9 p, 4 ref.

Descriptors: *Hydrologic data, *Computers, *Water resources, Computer programs, Data collections, Design data, Synthetic hydrology, Analytical techniques.
Identifiers: *Scarce data, Estimating missing data, Peru, Guatemala.

The minimum amount of recorded information required for a satisfactory analysis depends on the nature of the problem as well as the general statistical features of pertinent hydrologic phenomena. During the early development of electronic computers, principal uses were associated with the processing of large quantities of data. Now there is an important application of computers to work associated with scarce data. This includes elaborate analyses of statistical characteristics of available data and correlations between available data and associated phenomena. Methods that are used for extending available information in time and space, most of which involve the use of electronic computers, are described in this paper. The techniques used in this process extract a maximum amount of information from the available data and extend the information in space and time. Although techniques now developed can aid greatly in design of water structures, it is expected that future experience in their application will expand the utility of these techniques. (Woodard-USGS)
W71-02919

PREPARATION OF LONG TERM FLOW SEQUENCE FROM SHORT TERM RECORD BY STATISTICAL MEANS,
Ministry of Water and Power, Tehran (Iran).
For primary bibliographic entry see Field 02E.
W71-02920

WATER-LEVEL DATA FROM OBSERVATION WELLS IN THE SOUTHERN HIGH PLAINS OF TEXAS, 1965-70,
Texas Water Development Board, Austin.
A. Wayne Wyatt.
Texas Water Development Board Report 121, November 1970. 361 p, 54 ref.

Descriptors: *Groundwater, *Water wells, *Hydrologic data, *Water levels, *Texas, *Data collections, Aquifers, Water level fluctuations, Observation wells, Hydrographs, Water table, Depth, Elevation, Aquifer characteristics, Drawdown, Pumping.
Identifiers: *Well data, *Water-level measurements, *Southern High Plains (Tex).

Water-level records (1965-70) from approximately 1,500 wells which are located in 32 counties in the Southern High Plains of Texas are presented. The Ogallala Formation, the major aquifer underlying the Southern High Plains, varies in total thickness from a few feet to more than 500 feet in the approximately 31,000 square miles covered. A large upper part of this formation, however, is not saturated with water. The saturated thickness of the formation varies from less than 20 feet to more than 300 feet. Most of the wells from which water-level data are obtained are in areas of large withdrawals of groundwater for irrigation, industrial, and municipal use. The principal long-term changes in water levels have relfected decreases in the overall volume of water stored in the aquifer. Information concerning data tabulated for each well includes the well number, depth of well, elevation of land surface in feet above mean sea level, dates of measurement, measurements of water level in feet below land surface, and changes (decline or rise) in water level from the previous year's measurement. Hydrographs, showing changes in water level, are presented for selected representative wells following the respective county tabulations. (Woodard-USGS)
W71-02921

SURFACE WATER SUPPLY OF THE UNITED STATES, 1961-65: PART 9. COLORADO RIVER BASIN - VOLUME 2.
Geological Survey, Washington, D.C.

For sale by Superintendent of Documents, Government Printing Office, Wash, DC 20402 - Price $3.25. Geological Survey Water-Supply Paper 1925, 1970. 618 p, 1 fig, 1 plate.

Descriptors: *Hydrologic data, *Surface waters, *Streamflow, *Flow measurement, *Gaging stations, Colorado River basin, Data collections, Average flow, Low flow, Peak discharge, Lake stages, Reservoir stages, Stream gages.
Identifiers: *Streamflow basic-data.

Records of stage, discharge, and content of streams, lakes, and reservoirs in the Colorado River basin from the Green River near Daniel, Wyo., to the Colorado River at Compact Point, Ariz., are presented for the period October 1, 1960 to September 30, 1965. The tables of data include a description of the gaging station and tables showing daily, monthly, and yearly discharges of the stream. The table heading gives the station location, drainage area, records available, extremes of discharge, and general remarks. For most gaging stations on lakes and reservoirs the data presented comprise a description of the station and a monthly summary table of stage and contents. For some reservoirs a table showing daily contents or stage is given. A skeleton table of capacity at given stages is published for all reservoirs for which records are published on a daily basis. Data for partial-record stations are presented in two tables. The first is a table of discharge measurements at low-flow partial-record stations, and the second is a table of annual maximum stage and discharge at crest-stage stations. Occasionally, a series of discharge measurements are made within a short time period to investigate the seepage gains or losses along a reach of a stream or to determine the low-flow characteristics of an area. Such measurements are given in special tables following the tables of partial-record stations. (Woodard-USGS)
W71-02924

MISCELLANEOUS STREAMFLOW MEASUREMENTS IN IDAHO, 1894-1967,
Geological Survey, Boise, Idaho.
S. O. Decker, R. E. Hammond, and L. C. Kjelstrom.
Geological Survey Basic-data Release, 1970. 310 p.

Descriptors: *Surface waters, *Discharge measurement, *Data collections, *Idaho, Hydrologic data, Streamflow, Springs, Gaging stations, Watersheds (Basins), Water resources, Flow rates, Stream gages, Peak discharge, Inflow.
Identifiers: *Streamflow basic-data report, *Upper Columbia River Basin, *Snake River Basin, *Great Salt Lake Basin, Miscellaneous sites.

Presented is a compilation of all available streamflow measurements made in Idaho from 1894 to 1967 at miscellaneous sites and at crest-stage stations, including peak discharges at partial-record stations. Some sites are located in adjacent States on streams which enter Idaho. Each site has been assigned a number to conform to the US Geological Survey's gaging station numbering system. The number, name, location, discharge measurements, the stream or lake it is tributary to or diverts from, and other available data for each site are given and are arranged in downstream order. (Woodard-USGS)
W71-02927

ESTIMATING THE ACCURACY OF STATISTICAL FLOOD VALUES BY MEANS OF LONG-TERM DISCHARGE RECORDS AND HISTORICAL DATA,
For primary bibliographic entry see Field 02E.
W71-02939

ON THE METHOD OF UNIT HYDROGRAPH AND MODELLING OF RAINFALL FLOODS BY ELECTRONIC ANALOGUE COMPUTERS,
State Hydrological Inst., Leningrad (USSR).
For primary bibliographic entry see Field 02A.
W71-02944

COMPUTATION PRINCIPLES OF FLOOD HYDROGRAPHS,
State Hydrological Inst., Leningrad (USSR).
For primary bibliographic entry see Field 02A.
W71-02945

INCREASING THE ACCURACY OF DETERMINATION OF MAXIMUM DISCHARGES AND THEIR EXCEEDENCE PROBABILITY,
For primary bibliographic entry see Field 02E.
W71-02947

EXTRAPOLATION OF DISCHARGE RATING CURVES USING CHEZY'S FORMULA,
State Hydrological Inst., Leningrad (USSR).
For primary bibliographic entry see Field 02E.
W71-02948

THE WATER ENCYCLOPEDIA.
California Univ., Berkeley. Dept. of Civil Engineering.

David Keith Todd, Editor. Water Information Center Publication, Port Washington, New York, 1970. 559 p, 52 fig, 387 tab.

Descriptors: *Data collections, *Hydrological data, Water resources, Climates, Precipitation (Atmospheric), Water balance, Snowpacks, Snowmelt, Hydrologic cycle, Interception, Infiltration, Runoff, Consumptive use, Erosion, Sedimentation, Evapotranspiration, Evaporation, Streamflow, Surface waters, Groundwater, Groundwater movement, Water wells, Aquifers, Water utilization, Irrigation water, Industrial water, Municipal water, Water quality, Water pollution control, Water reuse, Sewage treatment, Water resources development, Water management (Applied), Governments, Legal aspects, Regulation, Water resources research act, Water properties, Physical properties.
Identifiers: *Water resources encyclopedia, *Water encyclopedia.

This reference volume contains a variety of world water resources data, facts, and statistics presented in 550 pages of tables. The subject matter includes climates, hydrology, surface and groundwater resources, water use and needs, and water quality. In addition, information on water resources agencies and constants and conversion factors is presented. Information is presented in tabular form; the only text consists of explanatory notes and footnotes to make the material readily understandable. To facilitate the rapid location of specific data, particular attention was given to making the index as complete as possible. Time-dependent data, such as hydropower development in the United States, are identified by date. The 9 chapters discuss climate and precipitation, hydrologic cycle elements, surface water, groundwater, water use, water quality and pollution control, water resources management, agencies and organization, and constants and conversion factors. (Knapp-USGS)
W71-03116

A STUDY OF WASTEWATER IRRIGATION THROUGH COMPUTER SIMULATION,
Bauer Engineering, Inc., Chicago, Ill.
For primary bibliographic entry see Field 05D.
W71-03126

CREST-STAGE GAGING STATIONS IN OREGON - A COMPILATION OF PEAK DATA COLLECTED FROM OCTOBER 1952 TO SEPTEMBER 1970,
Geological Survey, Portland, Oreg.
John Friday.
Geological Survey Open-file Report, October 1970. 71 p, 1 fig.

Descriptors: *Hydrologic data, *Peak discharge, *Gaging stations, *Oregon, Discharge (Water), Data collections, Runoff, Floods, Streamflow, Stream gages.
Identifiers: *Crest-stage gages, Peak flow.

This report contains a compilation of peak-flow data collected at crest-stage gaging stations in Oregon. Selected streams are gaged and the resulting data are used in a statistical analysis to generalize peak-flow characteristics. The peak data are the results of determining water-surface elevations (gage heights) at drainage structures and relating the gage heights to peak flow. Many of these structures are highway culverts, but small dams and bridges are also used. The structures provide a stable control for which a stage-discharge relation can be developed, and they also provide a means for computing the discharge in the event current-meter measurements cannot be made. Gaging-station records consist of a brief description of the location and physical features of each site, and a compilation of the peak data collected through the period of record. Basin characteristics, such as the mean elevation of the basin, channel slope, and the vegetal and geological features, are given if they have been evaluated. A total of 147 station records are compiled. Their locations are shown on a map. (Knapp-USGS)
W71-03133

GROUNDWATER ANALOGUES,
Melbourne Univ., Parkville (Australia). Dept. of Agricultural Engineering.
For primary bibliographic entry see Field 02F.
W71-03135

HYDROGEOLOGIC ELECTRIC ANALOGUE MODELS CONSTRUCTED BY THE SOUTH AUSTRALIAN MINES DEPARTMENT,
South Australia Dept. of Mines.
For primary bibliographic entry see Field 02F.
W71-03137

DIGITAL MODELS IN REGIONAL GROUNDWATER STUDIES,
New South Wales Univ., Kensington (Australia). School of Civil Engineering.
For primary bibliographic entry see Field 02F.
W71-03138

WIND EROSION EQUATION: COMPUTER SOLUTION AND APPLICATION,
Agricultural Research Service, Manhattan, Kans. Div. of Soil Erosion; and Kansas State Univ., Manhattan. Dept. of Statistics and Computer Science.
For primary bibliographic entry see Field 02J.
W71-03140

08. ENGINEERING WORKS

8A. Structures

THE STRESS DISTRIBUTION OF NORFORK DAM,
California Univ., Berkeley. Inst. of Engineering Research.
Ray W. Clough.
Available from NTIS as AD-701 898, $3.00 in paper copy, $0.95 in microfiche. Final Rept. to U.S. Engineering District, Little Rock, August 1962. 133 p. Rept. No. Ser-100-Issue-19, 9 ref.
Identifiers: *Dams, Stresses, Foundations (Structures), Loading (Mechanics), Reinforced concrete, Cracks, Shear stresses, Thermal stresses, Crack propagation, Mathematical models, Arkansas, Computer analysis, Computerized simulation, Finite element analysis, Norfolk Dam.

The stress distribution was investigated within the cross-section of a gravity dam. The analysis was performed by an automatic digital computer, using the finite element method. The principal purpose of the study was to determine the effect on the stress distribution of a vertical crack extending from the center of the base through most of the height of the section. The dam was subjected to dead load, live load, and thermal stress conditions; a total of 17 different loading and crack configurations were considered, including cases in which the foundation material was assumed to be orthotropically elastic.
W71-02841

LIMIT STATE DESIGN--A UNIFIED PROCEDURE FOR THE DESIGN OF STRUCTURES,
National Research Council of Canada, Ottawa (Ontario).
D. E. Allen.
Engineering Journal (Canada), Vol 53, No 2, p 18-29 and 35, Feb 1970. 13 p, 4 fig, 2 tab, 27 ref, 3 disc.

Descriptors: *Limit design, Load factors, *Structural design, Optimum design, Structural engineering, Bibliographies, Design criteria, Design, Foreign design practices, Structural analysis, Probability, Live loads, Safety factors, Dead loads.
Identifiers: *Design practices, Procedures, Canada, Allowable stress.

Limit state design is a unified procedure of design calculations for steel, reinforced concrete, wood, masonry, and soil structures. The method has been used in the USSR since 1954, and is being adopted in Europe for reinforced concrete design. Primary emphasis in limit state design is on the structural conditions that must be designed for--the limit states. Using partial safety factors leads to more intelligent safety considerations and greater economy; load factors and material or dimension factors are applied directly to the parameters to which they belong. Limit state design differentiates between dead load which promotes failure and carries an overload factor, and dead load which prevents failure and carries an underload factor; in regard to stability and stress reversal, safety is automatically assured without the need for special requirements. Examples of limit state design of a column and a simply supported beam or slab are given. Reasons for the increasing popularity of limit state design over existing procedures are given; shortcomings of existing design rules, criteria for structural design, and optimum design are reviewed. (USBR)
W71-02850

EARTHQUAKE RESPONSE OF CONCRETE GRAVITY DAMS,
California Univ., Berkeley.
A. K. Chopra.
Proc Amer Soc Civ Eng, J Eng Mech Div, Vol 96, No EM4, p 443-454, Aug 1970. 12 p, 4 fig, 3 tab, 15 ref, 2 append.

Descriptors: Dams, *Concrete dams, *Gravity dams, Dam design, Safety, *Earthquakes, Earthquake engineering, Structural behavior, Vibrations, Linear systems, Seismic design, Lateral forces, Fourier analysis, Earth movements, Numerical analysis, Analytical techniques, Two-dimensional, Equations, *Displacements, Bibliographies.
Identifiers: Earthquake control, Earthquake loads, Frequency response, *Dynamic response, Hydrodynamic pressures, Finite element method.

Earthquake response is simplified to a linear analysis of the 2-dimensional vibration of coupled reservoir-dam systems, with the response of the dam being approximated by deformations in the fundamental mode. Four cases considered are: (1) dam alone (without reservoir); (2) reservoir-dam system--interaction neglected; (3) reservoir-dam-system--interaction included; and (4) reservoir-dam system-interaction included, but water compressibility neglected. Expressions for the complex frequency response functions for the dam displacement and lateral hydrodynamic force in each of the 4 cases are presented. The results and the Fast Fourier Transform algorithm are used to compute the time-history of responses of 28 reservoir-dam systems to the Taft, Calif earthquake of 1952. Conclusions are: (1) the presence of the reservoir may increase the dam response significantly, and (2) the commonly used simpler analyses which neglect reservoir interaction or compressibility of water may result in significant error. (USBR)
W71-02853

SLAB BRIDGE DESIGN AND DRAWING--AN AUTOMATED PROCESS,
Atkins (W. S.) and Partners.
G. G. Aperghis.
Institution of Civil Engineers Proceedings, Vol 46, p 55-75, May 1970. 21 p, 11 fig, 7 tab, 16 ref.

Descriptors: *Bridge design, Bridges, *Slabs, Reinforced concrete, Cost comparisons, Prestressed concrete, *Computer programs, Drawing, Foreign design practices, Analytical techniques, Loads (Forces), Costs, Bibliographies, Optimization, Optimum design.
Identifiers: *Concrete slabs, *Computer-aided design, Drawings, Design improvements, Finite element method, Great Britain, Cost savings.

Significant improvements in slab bridge design achieved by using a computer program that analyzes, designs, details, and draws right or skew slabs of reinforced or prestressed concrete are described. The program incorporates: (1) accurate analysis based on the finite element method; (2) extensive treatment of loading; (3) thorough investigation of different methods of prestressing or placing reinforcement; and (4) optimization procedures for minimizing materials costs. Input data comprise the essentials for a particular application such as slab geometry, traffic and pedestrian arrangement, loading intensities, and materials properties; general data such as code specifications are stored in the program. Output consists of a printout of a bar schedule and supporting calculations and a construction drawing produced by a digital plotter. Accurate analysis and extensive loading treatment permit more confidence in the design, and optimization procedures result in better and lower cost bridges. Materials costs are compared for a bridge design using the computer program and using manual design methods. (USBR)
W71-02854

THE SAN SIMON WATERSHED; HISTORICAL REVIEW,
Arizona Univ., Tucson. Dept. of Watershed Management.
For primary bibliographic entry see Field 02J.
W71-02874

EFFECTS OF STREAM STRAIGHTENING ON FLOOD RUNOFF CHARACTERISTICS,
Iowa State Water Resources Research Inst., Ames.
For primary bibliographic entry see Field 04A.
W71-02881

THE TWICE-USED WATER,
For primary bibliographic entry see Field 02F.
W71-02959

TURBODRILL SOLVES TOUGH, COSTLY OPERATING PROBLEMS,
Compagnie Francaise des Petroles, Paris (France). Drilling Dept.
A. Brun.
World Oil, Vol 169, No 2, p 35-38, August 1969. 2 tab, 5 fig, 4 ref.

Descriptors: *Drilling, *Drilling equipment, Oil wells.
Identifiers: *Turbodrilling, *Drilling economics, *Drilling research, France, Rotary drilling versus turbodrilling, Energy delivery, Specific power transmission.

Broad application of turbodrills has proved tool's value for reducing trip frequency, increasing pentration rates, cutting costs, and for solving downhole drilling problems. On one test, a turbodrill completed a 6000 foot hole in 7 3/4 days whereas a standard rotary drill required 18 1/2 days to do the same job at the same location. The primary target of every drilling operation is to remove rock off bottom to make hole. Different forms of energy can be used: mechanical, hydraulic, thermal, chemical, nuclear, etc. Only mechanical and hydraulic energy are used at present. The specific power concept helps to confirm the value of the turbodrill. The specific power of a bit is energy transmitted to the bit divided by the section of the hole. It can be expressed by horse power per square inch. Figures are offered which illustrate that cable tools and classical rotary have relatively poor capability when compared to the turbodrill. (Campbell-NWWA)
W71-02983

THE SIMULATION OF PERCUSSION DRILLING IN THE LABORATORY BY INDEXED-BLOW STUDIES,
Pennsylvania State Univ., University Park.
H. L. Hartman, and Tze Chao.
Society of Petroleum Engineers Journal, p 214-226, September 1963. 1 tab, 12 fig, 9 ref.

Descriptors: *Rock properties, *Drilling, *Mining engineering, Rock mechanics, Boreholes, *Drilling research.
Identifiers: *Percussion drilling, Indexed-blow studies, Laboratory tests, Bedford limestone, Indiana, Indexing characteristics of chisel bits, Strain-time histories, Maximum strain relationships, Cable tool drilling.

The drop tester has proved an invaluable tool for the investigation of percussion drilling in the laboratory in 'slow motion'. It has allowed the process of rock penetration by impact to be studied a single blow at a time. In the present work, the relation of cratering to indexing has been determined under conditions simulating those in the bottom of the hole at atmospheric pressure. Indexed blows form craters which are influenced by others adjacent to them. Two unique effects are involved; (1) the provision of additional free faces in proximity to the point of impact and (2) the creation of subsurface damage by the previous blows. Both have a pronounced influence on the volume of rock removed per blow, which governs the rate of penetration in actual drilling. A single blow approach also has value in cable tool drilling. The results of this study are; (1) the optimum index distance on a damaged surface is greater than on a fresh, undamaged rock surface; (2) the volume of

rock broken at optimum index distance is about the same for both surface with wedge; (3) the optimum index distance and maximum crater volume are proportional to the energy level; (4) at a given energy level, the volume of rock broken by dies generally exceeds that by wedges; and (5) maximum crater volume varies, approximately, inversely with width of die but is nearly independent of included angle of wedge. (Campbell-NWWA)
W71-02997

DRILLING.

Transactions of the Society of Petroleum Engineers, AIME, 1963. 295 p, 78 ref.

Descriptors: *Rock properties, *Drilling fluids, *Rotary drilling, *Oil industry, Boreholes.
Identifiers: *Core barrel, *Soft rock drilling, Air drilling, Drill bit performance, Tool joint stress, Unconsolidated oil sands.

Thirty-one papers are included covering fundamental rock properties and breakage, and factors affecting drill bit performance, drilling fluids and problems of rheology, hydraulics and air drilling. Experimental stress analysis on tool joints in rotary drilling is examined as well as the development and field testing of core barrels for recovery in unconsolidated oil sands. An engineering appraisal of small diameter hole drilling in soft rock formations is also presented. (Campbell-NWWA)
W71-02998

EIGHT STEPS TO STOP LOST CIRCULATION,
Magnet Cove Barium Corp., Ark.
B. Q. Green.
Petroleum Engineer, Vol 35, No 3, p 100-111, March 1963. 2 fig.

Descriptors: *Oil wells, *Water wells, *Rotary drilling, Drilling fluids, Mud, Texas, Florida, Kansas, Louisiana.
Identifiers: *Lost circulation prevention, *Circulation thief zone, Mud pressure, Lost circulation materials, Texas, Louisiana, Kansas, Florida, Mud viscosity adjustment.

Eight ways are discussed to stop lost circulation, eg., (1) pull up bit and wait 4 to 8 hours for natural plugging, (2) reduce pressure and adjust mud viscosity, (3) batch squeeze with proper particle size, (4) locate points of loss and squeeze again, (5) increase maximum particle size of lost circulation material, (6) use special sizes and shapes of lost circulation material, (7) use reinforcing materials and (8) set protective casing. All lost-circulation problems in rotary drilling can be prevented if the effective downhole pressure can be reduced to equal the formation pressure. In areas where circulation losses are gradual rather than sudden, from 3 to 5 pounds per bbl of fine mica and/or nut shells for example should be carried with the mud to increase flow capacity of natural mud solids to bridge micro-openings that may grow into major circulation loses. Engineers have solved most of the severe lost circulation problems. A reduction of 50 to 90% has been realized in some areas. This success was due to considerations of (1) better casing programs (2) improved mud-weight control (3) better control of flow properties and (4) improved rig techniques. (Campbell-NWWA)
W71-02999

HOW TO COMBAT LOST CIRCULATION (PART 2).
National Lead Co., Houston, Tex. Baroid Div.

World Oil, Vol 155, No 3, p 80-90, August 1962. 5 fig.

Descriptors: *Oil wells, *Rotary drilling, Wells, Drilling fluids.
Identifiers: *Lost circulation, *State-by-state characteristics, Improved mud techology, Improved hydraulics and equipment handling techniques.

Lost circulation characteristics vary in different areas of the United States but the problems are being reduced by understanding the causes and by using improved mud technology, hydraulics and equipment handling techniques. The Gulf Coast area is of special concern. Loss of mud occurs in gravel beds, cavernous and highly permeable limestone and natural or induced fractures and fissures. Mud loss has been stopped with fibrous or flake materials especially designed as lost circulation materials. Cavernous and vugular formations that cause difficulty are coral beds. Drilling without return has been an accepted practice and blind drilling allows large volumes of water to be pumped into the hole, carrying the cuttings into the caverns. Surface casing is set when a depth is reached beyond which circulation can be expected. Methods and problems encountered have application to shallow exploration drilling for water or other minerals of economics interest. (Campbell-NWWA)
W71-03001

HOW MUCH CAN YOU PULL ON STUCK DRILL PIPE,
Pan American Petroleum Corp., Tulsa, Okla.
J. C. Stall, and K. A. Blenkarn.
World Oil, Vol 155, No 6, p 91-96, November 1962. 8 tab.

Descriptors: *Oil wells, *Rotary drilling, Wells, Drilling equipment, Drill monitors.
Identifiers: *Peak load, *Peak torque, *Stuck drill pipe, Allowable hook load calculations, Tensional strains, Torsional strains, Safe drilling procedure.

Calculations based on fundamental relationships are given on allowable hook load and torque combinations for commonly used drill pipe, including tool joints, subjected to combined tension, torsion and internal stress pressures. Strengths are given for both new and used pipe, and tables are based on minimum yield strengths. These calculations allow for normal circulating pressures, but do not allow for weakening effects of fatigue cracks, corrosion, or hydrogen embrittlement. Calculations and fundamental relationships have application to shallow exploration drilling for water or other economic minerals. (Campbell-NWWA)
W71-03002

THE THEORETICAL APPROACH TO TURBODRILLING,
Bureau de Coordination Technique, Paris (France).
W. Tiraspolsky.
World Oil, Vol 145, No 6, p 119-126, November 1957. 4 fig.

Descriptors: *Drilling, *Drilling equipment, Oil wells.
Identifiers: *Turbodrilling, *Drilling research, France, Germany, Russia.

Mechanical comparisons, illustrated with graphs of turbo and conventional drilling methods, indicates increased possibility of applying turbodrilling to industrial needs. Use and manufacture of turbodrills is discussed as well as its field application via favorable penetration rates compared with conventional rotary drilling methods. Historical development of the turbodrill is explored with emphasis on its future use. (Campbell-NWWA)
W71-03003

SUBCRITICAL FLOW AT OPEN CHANNEL STRUCTURES: BRIDGE CONSTRUCTIONS,
Utah Water Research Lab., Logan.
For primary bibliographic entry see Field 08B.
W71-03010

DETERMINATION OF DEPTH IN STILLING BASINS,
Bureau of Reclamation, Denver, Colo.
A. I. Kostin.

Translation of: Gidrotekhnicheskoe Stroitel'stvo, No 5, p 44, 1965. Available from NTIS as PB-193 621T, $3.00 in paper copy, $0.95 in microfiche. Bureau of Reclamation Translation, No 690, August 1967. 5 p, 1 fig.

Descriptors: *Stilling basins, Two dimensional, Hydraulics, Hydraulic structures, Hydrodynamics, Friction, Aprons, Velocity, Mathematical analysis, Water, Calculations, Flow resistance, Tailrace, Hydraulic jumps, Submergence, Fluid flow.
Identifiers: *Water depth, Foreign research.

A formula is derived for approximately calculating the water depth of a stilling basin with a baffle block. The formula may also be used for approximately calculating the water depth of a tailrace when no stilling basin is required. In practice, the error in determining water depth does not exceed 2 percent.
W71-03191

PLAN OF CHIRKEISK HYDROELECTRIC POWERPLANT ON THE SULAK RIVER,
Bureau of Reclamation, Denver, Colo.
For primary bibliographic entry see Field 08C.
W71-03194

TECHNICAL PLAN FOR EXPLOSIVE CONSTRUCTION OF BAIPAZINSK DAM ON THE VAKHSH RIVER,
Bureau of Reclamation, Denver, Colo.
For primary bibliographic entry see Field 08H.
W71-03195

ADVISORY CONFERENCE ON TUNNELLING, JUNE 22-26, 1970, WASHINGTON, D.C. ORGANIZATION FOR ECONOMIC CO-OPERATION AND DEVELOPMENT (OECD): WORKING PAPERS.
Organization for Economic Co-Operation and Development, Paris (France).

Available from NTIS as PB-193 286, $10.00 in paper copy, $0.95 in microfiche. June 1970. 607 p.
Identifiers: *Underground structures, Construction, *Construction, Symposia, Earth-handling equipment, Geology, Hydrology, Underwater equipment, Foreign policy, Costs, Questionnaires, Mining engineering, Transportation, Electric power production, Urban planning, Environment, *Tunneling-excavation, Demand (Economics), Public utilities, Management information systems.

Hard rock tunnelling, by T E Howard, Cut-and-cover construction, by J Schmidbauer; Soft-ground tunnelling, by J Deschamps; Immersed tunnel construction, by H C Wentink; Conference recommendations; Tunnelling demand 1960-1980; Research and development related to tunnelling. (See also W71-03209 thru W71-03215)
W71-03208

HARD ROCK TUNNELLING,
Organization for Economic Co-Operation and Development, Paris (France).
Thomas E. Howard.
Available from NTIS as PB-193 286-1, $3.00 in paper copy, $0.95 in microfiche. 72 p.
Identifiers: *Underground structures, *Construction, *Rock Geology, Drilling, Symposia, Questionnaires, Foreign policy, Geophysical prospecting, Mathematical prediction, Supports, Machines, Hydrology, Mechanics, Handling, Safety, Standardization, *Tunneling Excavation, *Hard rock tunneling, Management information systems, Technological improvement, Rock mechanics.

The report is intended to facilitate the orderly development of tunneling technology by focusing attention on the inadequacies of rock tunneling and the improvements that are needed. The data presented were derived from the results of a comprehensive questionnaire that was completed by individuals and organizations in 17 countries. (See also W71-03208)

W71-03209

CUT-AND-COVER CONSTRUCTION,
Organization for Economic Co-Operation and Development, Paris (France).
J. Schmidbauer.
Available from NTIS as PB-193 286-2, $3.00 in paper copy, $0.95 in microfiche. 61 p.
Identifiers: *Underground structures, *Construction, *Earth-handling equipment, Efficiency, Beams structural, Walls, Soil mechanics, Noise, Drilling, Hydrology, Problem solving, Foreign policy, Questionnaires, Symposia, *Cut and cover construction, Management information systems, *Tunneling excavation, Technical improvement.

The document is concerned with the cut-and-cover construction method which is much more frequently employed for building road tunnels in cities than are rock and soft-ground tunnelling. The purpose of the questionnaire was to promote the development of this method of construction and propose necessary improvements in view of the considerable amount of construction that will take place in the future. (See also W71-03208)
W71-03210

SOFT-GROUND TUNNELLING,
Organization for Economic Co-Operation and Development, Paris (France).
J. Deschamps.
Available from NTIS as PB-193 286-3, $3.00 in paper copy, $0.95 in microfiche. 129 p.
Identifiers: *Underground structures, *Construction, *Soils, Removal, Hydrology, Soil mechanics, Problem solving, Earth-handling equipment, Handling, Safety, Systems engineering, Symposia, Questionnaires, Foreign policy, *Tunneling, Excavation, *Soft ground tunneling, Management information systems, Technological improvement.

The report, which forms part of the enquiry undertaken by the Organization for Economic Cooperation and Development (O.E.C.D.) is concerned with the present-day inadequacies and improvements needed in the technology of softground tunneling. It is based on replies received from 17 countries, including the United States. (See also W71-03208)
W71-03211

IMMERSED TUNNEL CONSTRUCTION,
Organization for Economic Co-Operation and Development, Paris (France).
H. C. Wentink.
Available from NTIS as PB-193 286-4, $3.00 in paper copy, $0.95 in microfiche. 42 p.
Identifiers: *Underground structures, *Construction, *Assembling, Underwater, Steel, Cylindrical bodies, Coatings, Positioning devices, Machinery, United States, Rectangular bodies, Reinforced concrete, Western Europe, Geology, Hydrology, Soil mechanics, Symposia, Questionnaires, *Tunneling Excavation, *Immersed tunnels, Management information systems, Technological improvement.

The document is concerned with tunnels composed of elements constructed in a dry-dock or on a slipway and subsequently transported to the construction site, where they are sunk, placed on a foundation, and connected together under water. The questionnaire dealing with immersed tunnels brought in replies from twelve countries, many of which were based only on a theoretical knowledge of the subject or on experience with tunnels of very small cross-section. (See also W71-03208)
W71-03212

CONFERENCE RECOMMENDATIONS.
Organization for Economic Co-Operation and Development, Paris (France).

Available from NTIS as PB-193 286-5, $3.00 in paper copy, $0.95 in microfiche. 19 p.
Identifiers: *Underground structures, *Construction, Symposia, Cost effectiveness, Data processing systems, State-of-the-art reviews, Mathematical analysis, Geophysical prospecting, Law, Contracts, Public relations, Industrial training, Foreign policy, Urban planning, Recommendations, Management information systems, Technological improvement, *Tunneling Excavation, Benefit cost analysis.

The document contains recommendations concerning factors which have contributed to a reduced rate of progress in the art of tunneling. The object to be achieved is that of making the best use of tunneling in the interests of society. (See also W71-03208)
W71-03213

TUNNELLING DEMAND 1960-1980.
Organization for Economic Co-Operation and Development, Paris (France).

Available from NTIS as PB-193 286-6, $3.00 in paper copy, $0.95 in microfiche. 131 p.
Identifiers: *Underground structures, *Construction, *Economics, Underground structures, Statistical data, Factor analysis, Classification, Reviews, Costs, Approximation mathematics, Predictions, *Tunneling excavation, Demand economics, Management information systems.

The body of the report consists of four sections: a summary of a major findings and conclusions, an 18-country analysis of the data pertaining to underground excavation activities during the period 1960-1969, a comprehensive analysis of the data pertaining to the predicted demand for underground excavation during the period 1970-1979, and an analysis of the trends in the evolution of comprehensive tunneling demand over the period 1960-80. (See also W71-03208)
W71-03214

RESEARCH AND DEVELOPMENT RELATED TO TUNNELLING.
Organization for Economic Co-Operation and Development, Paris (France).

Available from NTIS as PB-193 286-7, $3.00 in paper copy, $0.95 in microfiche. 105 p.
Identifiers: *Underground structures, *Construction, Symposia, Questionnaires, Research program administration, Structures, Terrain, Organizations, Foreign policy, Statistical data, Costs, Classification, *Tunneling excavation, Research and development, Management information systems.

The document is concerned with the status of applied research and development relating to tunneling technology. Applied research and development means theoretical and experimental studies of new design methods and construction techniques including studies of the properties, character and behavior of tunnel structures and of the ground mass in which they are constructed. (See also W71-03208)
W71-03215

8B. Hydraulics

SPILLWAY DESIGN FLOOD FOR DAMS IN IRAN,
Iran Plan Organization, Tehran.
For primary bibliographic entry see Field 04A.
W71-02809

FLOW SEPARATION IN TIME VARYING FLOW,
Colorado State Univ., Fort Collins. Fluid Dynamics and Diffusion Lab.
Fang-Kuo Chou, and V. A. Sandborn.
Available from NTIS as AD-700 926, $3.00 in paper copy, $0.95 in microfiche. Project THEMIS Technical Report No 6, December, 1969. 62 p, 3 tab, 15 fig, 21 ref. ONR N00014-68-A0493-0001.
Identifiers: *Flow separation, Boundary layer, Shear stresses, Relaxation time, Pipes, Velocity, Correlation techniques, Flat plate, Models, Periodic variations, Themis project, Shear flow.

An exact solution of time varying pipe flow with a fluctuating velocity superimposed on the mean flow is analyzed. The velocity profiles, together with the profile parameters at separation, are computed from a computer program. The results are compared with the model for relaxed (steady) and unrelaxed (unsteady) separation criteria proposed by V A Sandborn and S J Kline. For very low frequencies, the correlation curves appear to have a reasonable agreement with the proposed relaxed separation criterion. For high frequencies, the correlation curves were found to fall approximately on the unrelaxed separation criterion. This result demonstrates further that adjustment time is an important factor for separation to be relaxed or unrelaxed, a new concept proposed by Sandborn. In addition, J T Stuart's solution for the flow along an infinite flat plate with normal suction and periodic external velocity is further analyzed. The results again prove to agree with the proposed new concept.
W71-02835

OBSERVATIONS OF DEEP-WATER RENEWAL IN THE CARIBBEAN SEA,
Rhode Island Univ., Kingston. Graduate School of Oceanography.
For primary bibliographic entry see Field 02A.
W71-02897

SIGNIFICANCE OF CAMILLE (1969),
Florida State Univ., Tallahassee. Dept. of Geology.
For primary bibliographic entry see Field 02B.
W71-02908

IMPACT-TYPE ENERGY DISSIPATOR FOR STORM-DRAINAGE OUTFALLS STILLING WELL DESIGN.
Army Engineer Waterways Experiment Station, Vicksburg, Miss.
For primary bibliographic entry see Field 04A.
W71-02954

FLOW CONCENTRATION GROINS FOR REAERATION IN PASSAIC RIVER - A HYDRAULIC MODEL STUDY,
Rutgers - The State Univ., New Brunswick, N.J. Water Resources Research Inst.
For primary bibliographic entry see Field 05G.
W71-03009

SUBCRITICAL FLOW AT OPEN CHANNEL STRUCTURES: BRIDGE CONSTRUCTIONS,
Utah Water Research Lab., Logan.
Gaylord V. Skogerboe, Lloyd H. Austin, and Kuan-Tao Chang.
Available from NTIS as PB-196 477, $3.00 in paper copy, $0.95 in microfiche. Partial Technical Completion Report, Utah Center for Water Resources Research, Logan, Report PRWG 71-2, September 1970. 153 p, 3 tab, 41 fig, 27 ref, append. OWRR Project B-018-UTAH (2).

Descriptors: Backwater, *Bridges, *Energy losses, Head loss, Hydraulic design, *Hydraulic structures, Non-uniform flow, *Open channel flow, Subcritical flow.

Techniques previously employed for describing subcritical flow at open channel constrictions have been found valid for analyzing nonuniform flow in open channels. Combining the nonuniform flow analysis with the submerged flow ratings for various bridge geometries has provided an analytical means for determining the backwater due to the bridge constriction under 'abnormal stage-discharge' conditions. (See W69-00989, W69-01146, and W68-01022).
W71-03010

8C. Hydraulic Machinery

LITTLE FALLS FIBRE CO V HENRY FORD AND SON (LIABILITY FOR LOSS OF POWER HEAD UPSTREAM FROM DAM AND HYDROELECTRIC PLANT).
For primary bibliographic entry see Field 06E.
W71-02844

RELAY COORDINATION FIELD TESTS OF THE 138-KV SYSTEM - COLORADO RIVER STORAGE PROJECT,
Bureau of Reclamation, Denver, Colo.
G. W. Cleaveland.
Bureau of Reclamation Report REC-OCE-70-14, May 1970. 15 p, 6 fig, 3 tab, 5 oscillogram, 2 ref.

Descriptors: *Electric relays, Alternating current, Circuit breakers, Electric arcs, Electrical impedance, Electrical networks, *Coordination, *Faults (Electrical), Hydroelectric plants, Oscillographs, Transmission lines, Substations (Electrical), Switchyards (Electrical), Transmission (Electrical), Powerline carriers, Test procedures.
Identifiers: *Protective relaying, Interconnected systems, Microwave carrier, Transfer tripping, *Staged fault tests, Test results.

Relay coordination staged fault tests were conducted on the Bureau of Reclamation 138-kv system between Flaming Gorge Powerplant and Hayden Substation, Colorado River Storage Project. The tests were particularly important in verifying relay coordination for the 3-terminal line interconnecting the Vernal, SW Rangely, and Hayden Substations. The line uses a direct underreaching transfer trip protective relaying scheme over a microwave channel between Hayden and Vernal and a powerline carrier channel between Vernal and SW Rangely. The tests identified a few incidents of relay misoperation on the Flaming Gorge-Vernal lines, but demonstrated satisfactory operation on the 3-terminal line, including faults at the critical fault location. In addition, the tests demonstrated satisfactory transmission of carrier through a transitory fault. Relay operations, fault current values, and transfer trip clearing and transit times for the staged fault tests are summarized. (USBR)
W71-02845

FIELD TESTING OF EXTRA-HIGH-VOLTAGE CABLES,
Hitachi Cable Ltd., Tokyo (Japan).
N. Ando.
Hitachi Review, Vol 19, No 8, p 293-299, 1970. 7 p, 6 fig, 3 tab, 12 ref.

Descriptors: *Field tests, *Electric cables, *Extra high voltage, Test facilities, Aging (Physical), Performance, Electric currents, Mechanical properties, Electric insulation, Temperature, Foreign research, Sensors, Instrumentation, Simulation, Electrical properties, Test procedures, Stress.
Identifiers: Japan, *Foreign testing, *Pipe-type cables, Temperature rise, Oil-filled cables.

To meet the increasing concentrated power demand in urban districts, extra-high-voltage cables are being introduced. The cables must offer stable long-term performance and good initial performance. Because the cables are installed in construction work on-site and are subjected to greater electrical and mechanical stresses as the voltage increases, various factors inducing aging that are encountered during operation must be predicted if long-term performance is to be guaranteed. To determine aging factors and intensity, long-term voltage and thermal endurance tests, including accelerated aging tests, were conducted. Field tests of extra-high-voltage cables for guaranteeing a long service life are described, with special reference to 275-kv cables. In the tests, in which actual operation is simulated, setting of test conditions is important because the sample must be subjected to severe conditions to find long-term reliability in a short period. Results are described for sample cables and accessories, and considerations for setting of test conditions are discussed. (USBR)
W71-02847

VACUUM FREEZING VAPOR-COMPRESSION PROCESS: 60,000 GPD PILOT PLANT EVALUATION,
Colt Industries, Inc., Beloit, Wis.
For primary bibliographic entry see Field 03A.
W71-02952

HOW TO SELECT AND USE DRILL BITS PROFITABLY,
Delta Drilling Co., Tyler, Tex.
R. R. Hudeck.
World Oil, Vol 169, No 4, p 73-77, September 1969. 7 fig, 1 ref.

Descriptors: *Oil wells, *Rotary drilling, Drilling equipment, Drilling economics.
Identifiers: *Drill-bit economics, Bit life, Bit wear, Bit designs, Bit applications, Trip reduction.

Although rock bit shapes are similar, the angle and length and design of the teeth must change for soft through hard formations. This article describes how to recognize, understand and apply these varied bit designs to best advantage. Understanding and properly applying the many bit designs now available will allow wells to be drilled faster at lower cost. By selecting and using the proper bit and by programing rig performance to match bit capabilities, the contractor can also: (1) drill straighter and safer hole, (2) reduce fishing jobs, (3) improve design of bottom hole assemblies (4) reduce trips and (5) apply optimum weight and rpm if formation characteristics are known. (Campbell-NWWA)
W71-02985

PLAN OF CHIRKEISK HYDROELECTRIC POWERPLANT ON THE SULAK RIVER,
Bureau of Reclamation, Denver, Colo.
I. P. Aleshin.
Translated from: Gidrotekhnicheskoe Stroitel'stvo, No 5, p 13-16, 1962. Available from NTIS as PB-193 769T, $3.00 in paper copy, $0.95 in microfiche. Bureau of Reclamation Translation, No 647, March 1969. 15 p, 4 fig.

Descriptors: Project planning, *Underground powerplant, Underground structures, Engineering geology, Tunnels, Penstocks, Electric power costs, Intake towers, *Arch dams, Reservoirs, Concrete structures, Spillways, Limestones, *Hydroelectric powerplants, Flood control, Irrigation, Preliminary investigations, *River basin development, Water management, Draft tubes, *Foreign projects.
Identifiers: Chirkeisk Powerplant (USSR), USSR, Comparative studies, Chirkei hydro proj (USSR), Sulak Cascade System (USSR), Outlet tunnels.

Chirkeisk Dam and Powerplant is the second and an important step in the multipurpose cascade of the Sulak river and its tributaries, flowing down the steep Northern Caucasus slopes across coastal lowlands to the Caspian Sea. The completed cascade through its reservoirs will regulate the rivers to provide power and full water management to the land mass downstream, including flood control, sedimentation, and water for irrigation. Chirkeisk Hydrocomplex consists of a nonoverflow concrete-arch dam, tower intake structure, underground powerplant, outlet tunnel, controlled spillway, and switchyard. Construction is in a narrow gorge, cutting through strongly layered limestones, which when grouted will provide a solid monolithic and impervious foundation. Engineering geology, project planning to select the type of structure most feasible, results of some preliminary surveys and tests, and the structures selected are described.
W71-03194

BRATSK HYDROELECTRIC POWERPLANT,
Bureau of Reclamation, Denver, Colo.
A. D. Sakov, B. Z. Umanskii, and N. I. Fedotov.
Translated from: Elektricheskie Stantsii, No 1, p 7-13, 1963. Available from NTIS as PB-193 591, $3.00 in paper copy, $0.95 in microfiche. Bureau of Reclamation Translation, No 664, July 1966. 25 p, 5 fig.

Descriptors: *Hydroelectric powerplants, Electric currents, Electric cables, *Electrical equipment, Bus (Electrical), Electric generators, *Switchyards (Electrical), Transmission (Electrical), Remote control systems, Telemetry systems, Power system operations, Hydroelectric power, Alternating currents, Powerplants, *Extra high voltage, Electric switches, Power transformers, Voltage regulators, Ammeters, Wattmeters, Circuits, Electric potential, Foreign projects, Foreign design practices, Electrical networks, Excitation, Extra long distance.
Identifiers: Electric conductors, *Bratsk Powerplant (USSR), USSR, Electrical design.

Bratsk Hydrocomplex on the Angara River in Siberia will produce and distribute 4,500 mw of power of 500 kv to the Siberian grid and 220 kv to the regional network and local consumers. This article, written as the first units went on the line, gives concise information on the powerplant, its installations, layout, excitation system, station-service circuits, 220-kv and 500-kv open-air switchyards, control system, power and other electrical equipment and operating personnel. Schematic diagrams of the various circuits, control board layout, and possible operating variations designed to prevent outages are given. Many major electrical components, such as transformers are described and identified by type and number.
W71-03196

8D. Soil Mechanics

IN-PLACE TREATMENT OF FOUNDATION SOILS,
California Univ., Berkeley.
J. K. Mitchell.
Proc Amer Soc Civ Eng, J Soil Mech Found Div, Vol 96, No SM1, p 73-110, Jan 1970. 38 p, 21 fig, 5 tab, 88 ref, append.

Descriptors: Blasts, Chemical stability, Compaction, *Electro-osmosis, *Foundations, *Grouting, Piles (Foundations), Relative density, Soil mechanics, Soil stabilization, Bibliographies.
Identifiers: Vibroflotation, Electrokinetic potential.

The state-of-the-art of 7 special methods for treating soils to support structures is reviewed. Vibroflotation, Compaction piles, blasting, and grouting are limited mainly to the treatment of cohesionless soils; electro-osmosis, thermal treatment, and treatment with additives find primary application in the treatment of cohesive soils. Although blasting is usually the fastest and least expensive, compared with vibroflotation and compaction piles, the results are the least certain. Installation of stone column piles by vibroflotation has extended the range of application of this method into cohesive soils. Recently developed chemical grouts are now approaching the ideal in terms of viscosity and control of setting time. Mixed-in-place intrusion grouting appears to be a promising technique for constructing soil-cement piles in place. Additive stabilization of foundation soils for structures is used mainly in connection with grouting and electro-osmosis, with additional application to the treatment of expansive soils to shallow depths. Has 88 references. (USBR)
W71-02857

SHORT PERIOD VARIATION IN LAND SUBSIDENCE,
Tokyo, Japan.
For primary bibliographic entry see Field 02F.
W71-02906

ON THE INFLUENCE OF OCEANIC TIDES UPON ARTESIAN HEAD AND SURFACE LEVEL OF LAND,
Saitama Univ., Urawa (Japan). Dept. of Science and Technology.
For primary bibliographic entry see Field 02F.
W71-02907

LAND SUBSIDENCE; PROCEEDINGS OF THE TOKYO SYMPOSIUM, SEPTEMBER 1969.
For primary bibliographic entry see Field 02F.
W71-03148

DIRECTIONS OF RESEARCH ON LAND SUBSIDENCE,
Komazawa Univ., Tokyo (Japan).
For primary bibliographic entry see Field 02F.
W71-03149

STATUS OF PRESENT KNOWLEDGE AND NEEDS FOR ADDITIONAL RESEARCH ON COMPACTION OF AQUIFER SYSTEMS,
Geological Survey, Sacramento, Calif.
For primary bibliographic entry see Field 02F.
W71-03150

LAND SUBSIDENCE PROBLEMS IN TAIPEI BASIN,
For primary bibliographic entry see Field 02F.
W71-03151

LAND-SURFACE SUBSIDENCE IN THE HOUSTON-GALVESTON REGION, TEXAS,
Geological Survey, Houston, Tex.
For primary bibliographic entry see Field 02F.
W71-03152

SURFACE DEFORMATION ASSOCIATED WITH OIL AND GAS FIELD OPERATIONS IN THE UNITED STATES,
Geological Survey, Menlo Park, Calif.
For primary bibliographic entry see Field 02F.
W71-03153

SUBSIDENCE IN THE WILMINGTON OIL FIELD, LONG BEACH, CALIFORNIA, U.S.A.,
Long Beach Dept. of Oil Properties, Calif.
For primary bibliographic entry see Field 02F.
W71-03154

LAND SUBSIDENCE IN THE TOKYO DELTAIC PLAIN,
Tokyo Metropolitan Univ. (Japan). Dept. of Science and Engineering.
For primary bibliographic entry see Field 02F.
W71-03155

REVIEWS OF LAND SUBSIDENCE RESEARCHES IN TOKYO,
Tokyo Inst. of Civil Engineering (Japan).
For primary bibliographic entry see Field 02F.
W71-03156

RESULTS OF REPEATED PRECISE LEVELLINGS IN LAND SUBSIDENCE AREA IN TOKYO,
Tokyo Inst. of Civil Engineering (Japan); and Komazawa Univ. (Tokyo).
For primary bibliographic entry see Field 02F.
W71-03157

LAND SUBSIDENCE IN OSAKA,
Kyoto Univ. (Japan). Disasters Prevention Research Inst.
For primary bibliographic entry see Field 02F.
W71-03158

ANALYSIS OF LAND SUBSIDENCE IN NIIGATA,
Ministry of Transportation, Yokosuka (Japan). Port and Harbor Research Inst.
For primary bibliographic entry see Field 02F.
W71-03159

TRITIUM DATING OF LAND SUBSIDENCE IN NIIGATA,
For primary bibliographic entry see Field 02F.
W71-03160

SHRINKAGE OF SUBAQUEOUS SEDIMENTS OF LAKE IJSSEL (THE NETHERLANDS) AFTER RECLAMATION,
Yssel Lake Development Authority, Kampen (Netherlands).
For primary bibliographic entry see Field 02F.
W71-03161

THE HYDROLOGIC BALANCE IN THE LAND SUBSIDENCE PHENOMENA,
Research Inst. for Natural Resources, Tokyo (Japan); Kokusai Aerial Surveys Co. Ltd., Tokyo (Japan); and Tokyo Univ. (Japan). Dept. of Engineering.
For primary bibliographic entry see Field 02F.
W71-03162

NIIGATA GROUND SUBSIDENCE AND GROUNDWATER CHANGE,
For primary bibliographic entry see Field 02F.
W71-03163

SUBSIDENCE IN THE NORTH GERMAN COASTAL REGION,
For primary bibliographic entry see Field 02F.
W71-03164

A LINEAR RELATIONSHIP BETWEEN LIQUID PRODUCTION AND OIL-FIELD SUBSIDENCE,
Geological Survey, Menlo Park.
For primary bibliographic entry see Field 02F.
W71-03165

EFFECTS OF MINING SUBSIDENCES ON THE GROUNDWATER AND REMEDIAL MEASURES,
Bochum Univ. (West Germany).
For primary bibliographic entry see Field 02F.
W71-03166

SURFACE SUBSIDENCE AND SINKHOLES IN THE DOLOMITIC AREAS OF THE FAR WEST RAND, TRANSVAAL, REPUBLIC OF SOUTH AFRICA,
Dept. of Mines, Johannesburg (South Africa); and Geological Survey, Pretoria (South Africa).
For primary bibliographic entry see Field 02F.
W71-03167

DAMAGE TO IRRIGATION POND DUE TO MINING SUBSIDENCE,
Kyushu Univ., Fukuoka City (Japan). Research Inst. of Science and Industry.
For primary bibliographic entry see Field 02F.
W71-03168

ON THE COMPRESSION SUBSIDENCE OF PEAT AND HUMIC LAYERS IN THE KAMI-SHINBASHI AREA, KURATE-MACHI, KURATE-GUN, FUKUOKA PREFECTURE,
Kyushu Univ., Fukuoka (Japan). Dept. of Engineering.
For primary bibliographic entry see Field 02F.
W71-03169

SMALL SINKING HOLES IN LIMESTONE AREA WITH SPECIAL REFERENCE TO DRAINAGE OF COAL MINES,
Kyushu Univ., Fukuoka (Japan). Dept. of Engineering.
For primary bibliographic entry see Field 02F.
W71-03170

CONSOLIDATION PHENOMENON CAUSED BY MINE DRAINAGE IN THE AREA OUTLYING FROM WORKING PLACE,
Kyushu Univ., Fukuoka (Japan). Dept. of Engineering.
For primary bibliographic entry see Field 02F.
W71-03171

MODEL STUDIES OF DIFFERENTIAL COMPACTION,
Georgia Univ., Athens.
For primary bibliographic entry see Field 02F.
W71-03172

MODEL EXPERIMENTS ON LAND SUBSIDENCE,
Kyoto Univ. (Japan). Disasters Prevention Research Inst.
For primary bibliographic entry see Field 02F.
W71-03173

ANALYSIS OF BOREHOLE EXTENSOMETER DATA FROM CENTRAL CALIFORNIA,
Geological Survey, Sacramento, Calif.
For primary bibliographic entry see Field 02F.
W71-03174

THE MECHANICS OF COMPACTION AND REBOUND, WILMINGTON OIL FIELD, LONG BEACH, CALIFORNIA, U.S.A.
Long Beach Dept. of Oil Properties, Calif.
For primary bibliographic entry see Field 02F.
W71-03175

OBSERVATION OF COMPACTION OF FORMATION IN THE LAND SUBSIDENCE OF NIIGATA CITY,
Industrial Science and Technology Agency, Kawasaki (Japan). Geological Survey.
For primary bibliographic entry see Field 02F.
W71-03176

FINITE ELEMENT ANALYSIS OF LAND SUBSIDENCE,
Ohio State Univ., Columbus. Dept. of Civil Engineering; and California Univ., Berkeley. Dept. of Civil Engineering.
For primary bibliographic entry see Field 02F.
W71-03177

SAND COMPRESSION AS A FACTOR IN OIL FIELD SUBSIDENCE,
San Jose State Coll., Calif. Dept. of Civil Engineering.
For primary bibliographic entry see Field 02F.
W71-03178

COMPRESSIBILITIES OF CLAYS AND SOME MEANS OF PREDICTING AND PREVENTING SUBSIDENCE,
University of Southern California, Los Angeles. Dept. of Petroleum Engineering.
For primary bibliographic entry see Field 02F.
W71-03179

SOIL-WATER DISEQUILIBRIUM AS A CAUSE OF SUBSIDENCE IN NATURAL SOILS AND EARTH EMBANKMENTS,
Commonwealth Scientific and Industrial Research Organization, Melbourne (Australia). Div. of Soil Mechanics.
For primary bibliographic entry see Field 02F.

W71-03180

STUDIES ON PARTIAL COMPACTION OF SOIL LAYER IN REFERENCE TO LAND SUBSIDENCE IN TOKYO,
Tokyo Inst. of Civil Engineering (Japan); and Komazawa Univ., Tokyo (Japan).
For primary bibliographic entry see Field 02F.
W71-03181

SHORT-TERM MOVEMENT OF THE LAND SURFACE NEAR WATER WELLS,
Hawaii Univ., Honolulu. Dept. of Geosciences.
For primary bibliographic entry see Field 02F.
W71-03182

MODERN ROCKFILL DAMS, INCLUDING ROCKFILL REINFORCED EARTH DAMS: PLANNING, DESIGN AND CONSTRUCTION,
National Science Foundation, Washington, D.C.
R. A. Airapetyan.
Transl. of Proektirovanie Kamennonabeosnykh I Kamennozemlyanykh Plotin, Moscow 1968. Available from NTIS as TT-70-50024, $3.00 in paper copy, $0.95 in microfiche. Israel Program for Scientific Translations, Jerusalem, 1970. 205 p.
Identifiers: *Rockfill dams, Design criteria, Earth dams, Slope protection, Curtain walls, Polymeric films, Stability methods, Pore pressure, Structural analysis, Soil dynamics, USSR, Translations.

The book deals with the principal design and construction problems of modern rockfill and rockfill-reinforced earth dams. In providing a detailed review of dams built in the last hundred years and an analysis of the design and construction principals of recently built dams, the author offers guidelines on the choice of type, design and materials for rockfill dams, as well as on their analysis and the required computations. The author mainly dwells on questions applying to high and 'super-high' dams, such as are being built on a large scale at present. Appendices provide the principal data on 56 dams, completed or under construction, and descriptions of 13 of the most remarkable of them.
W71-03197

8E. Rock Mechanics and Geology

ROCK MECHANICS TESTING AS RELATED TO MICA POWER FACILITIES,
CASECO Consultants Ltd., Vancouver (British Columbia).
P. Meidal, and J. L. Webster.
Engineering Journal (Canada), Vol 53, No 7, p 11-20, July 1970. 10 p, 9 fig, 4 ref, 2 disc.

Descriptors: *Rock mechanics, Rock properties, Foreign projects, Test procedures, *Underground powerplants, Engineering geology, Exploration, Tunnels, Tunnel pressures, Laboratory tests, Foreign construction, Testing.
Identifiers: *Rock tests, Underground openings, Plate load tests, Mica Dam, Canada, Borehole extensometers, Flat jack method, *In situ tests.

Rock mechanics testing in an exploratory tunnel excavated into the location of the proposed underground powerhouse at Mica Dam in Canada is described. Geological investigations and in situ and laboratory tests were made to determine the elastic and inelastic properties of the rock. Flat jacks, borehole deformation meter, borehole extensometers, and steel sets instrumented with load cells were used, and plate loading tests and measurements by precise survey methods were made. Results and their influence on the design of underground structures are discussed. Modifications to the powerhouse arrangement, selected on the basis of preliminary investigations, are described; additional work required to determine the optimum shape of the underground openings is outlined. (USBR)
W71-02846

8F. Concrete

GUIDE TO JOINT SEALANTS FOR CONCRETE STRUCTURES.
American Concrete Inst., Detroit, Mich.

Journal of American Concrete Institute, Proceedings Vol 67, No 7, p 489-536, July 1970. 48 p, 27 fig, 5 tab, 14 ref. 3 append.

Descriptors: *Joint fillers, *Sealing compounds, *Concrete structures, *Joints (Connections), Concrete construction, Construction joints, Tanks (Containers), Concrete pipes, Concrete dams, Cracking, Mastics, Precast concrete, Reinforced concrete, Thermoplastics, Repairing, Linings, Seals (Stoppers), Concretes, Expansion joints, Buildings, Gaskets, Performance.
Identifiers: Compression joint seals, Concrete pavements, Concrete slabs, Control joints, Thermosetting resins.

Most joints and some cracks in concrete structures require sealing against the adverse effects of environmental and service conditions. The report is a guide to better understanding properties of joint sealants and where and how they are used in present practice. Described and illustrated are: (1) the functioning of joint sealants; (2) required properties, available materials, and applicable specifications for field-molded sealants and preformed sealants such as waterstops, gaskets, or compression seals; (3) determination of joint movements, widths, and depths; (4) outline details of joints and sealants used in general structures, fluid containers, and pavements; (5) methods and equipment for sealant installation including preparatory work; (6) performance of sealants; and (7) methods of repairing defective work or maintenance resealing. Improvements needed to ensure better joint sealing in the future are indicated. (USBR)
W71-02849

ALLOWABLE TENSILE STRESSES FOR PRESTRESSED CONCRETE.
Prestressed Concrete Inst., Chicago, Ill. Committee on Allowable Stresses in Presstressed Concrete Design.

Journal of Prestressed Concrete Institute, Vol 15, No 1, p 37-42, Feb 1970. 6 p, 3 fig, 2 tab, 3 ref.

Descriptors: *Tensile stress, *Prestressed concrete, Laboratory tests, *Beams (Structural), Structural members, Structural design, Deflection, Structural engineering, *Building codes, Structural behavior, Overloads, Cracking, Design standards, Safety factors.
Identifiers: *Allowable stress, American Concrete Inst, Analytical method, Camber.

Some provisions of the 1963 ACI Building Code kept prestressed concrete from meeting the serviceability requirements. Work of the PCI Committee, formed to recommend higher allowable tensile stresses in prestressed concrete flexural members while maintaining serviceability requirements, was largely responsible for changes in allowable stresses in the draft of the revised ACI code presented in the Feb 1970 ACI Journal. Rationale behind the use of higher allowable tensile stresses is given. Historically, serviceability of prestressed concrete beams has been controlled by specifying allowable stresses. Use of stress limits will not always provide satisfactory behavior. Two extreme cases are: (1) camber growth caused by small allowable tensile stress and large temporary loads; and (2) unsatisfactory deflection behavior caused by loss of stiffness when loaded above the cracking level. In view of these extremes, any recommended allowable tensile stress depends on the deflection characteristics of the beam above and below the cracking load. A simplified method of determining an allowable tensile stress, with a bilinear assumption of load-deflection behavior, and based on the post-cracking behavior of bonded prestressed concrete beams, is presented. (USBR)
W71-02851

EARTHQUAKE RESPONSE OF CONCRETE GRAVITY DAMS,
California Univ., Berkeley.
For primary bibliographic entry see Field 08A.
W71-02853

SLAB BRIDGE DESIGN AND DRAWING--AN AUTOMATED PROCESS,
Atkins (W. S.) and Partners.
For primary bibliographic entry see Field 08A.
W71-02854

8G. Materials

DURABILITY OF POLYMER FILM SEEPAGE SHIELDS,
Bureau of Reclamation, Denver, Colo.
V. V. Sokolskaya.
Translated from: Gidrotekhnicheskoe Stroitel'stvo, No 11, p 18-21, 1969, Bound with original text. Available from NTIS as PB-193 664T, $3.00 in paper copy, $0.95 in microfiche. Bureau of Reclamation Translation, No 836, March 1970. 7 p, 12 fig, 1 tab, 6 ref.

Descriptors: *Polymers, *Films, *Durability, *Hydraulic structures, Seepage, Shields, Construction materials, Waterproofing, Linings, Materials stability.
Identifiers: *Seepage control.

Experience with the polymer film seepage shields in hydrotechnical construction are technically and economically sound. Seepage practically ceases in constructions with such shields and their technology is simple. In the Soviet Union, polymer film shields were introduced in the irrigation canals of the Golodnaya Steppe in 1958. At present, many institutes of research and design, as well as construction organizations, are engaged in designing and making seepage shields from film polymers for water-storage reservoirs, dams of native material, brine storage reservoirs, and sludge dumps.
W71-03193

8H. Rapid Excavation

TECHNICAL PLAN FOR EXPLOSIVE CONSTRUCTION OF BAIPAZINSK DAM ON THE VAKHSH RIVER,
Bureau of Reclamation, Denver, Colo.
E. N. Agareva.
Translated from the Russian: Trudy V sessii uchenogo soveta po narodnokhoziaistvennomu ispol'zovaniiu vzryva, Akademiia nauk Kirgizskoi SSR, Frunze, p 254-258, 1965. Available from NTIS as PB-193 767, $3.00 in paper copy, $0.95 in microfiche. Bureau of Reclamation Translation, No 780, September 1968. 11 p, 4 fig.

Descriptors: Foreign design practices, Foreign projects, *Explosions, Explosives, *Rockfill dams, Diversion dams, Tunnels, Charges (Explosives), Limestones, Spillways, Construction, Construction costs, Economics, Gradation, Gravels, Fragmentation, Project planning, *River closures, Safety factors, Dam design.
Identifiers: USSR, Baipazinsk Dam (USSR), Vakhsh River (USSR), *Explosive construction, Nurek Powerplant (USSR), *Slide dams.

The USSR plans to construct a rockfill dam by exploding rock across the Vakhsh River in Tadzhikistan below Nurek Hydropowerplant to divert irrigation water to the Iavansk and Obi-Kuksk Valleys. The 55-m-high nonoverflow dam, containing 622,000 cu meters of excavated materials, will be formed by fracturing and moving a total volume of 1,470,000 cu meters of layered limestone from the steep right bank into the riverbed. Discharge in March, time of the explosions, is 200-400 cu meters per second and velocity 3-5 meters per second. A spillway with four 10-m-wide openings, sluice, stilling basin, and feeder and drainage canals will be constructed before exploding the dam. A

concrete-lined diversion tunnel, 7.5 km long and 5.1 m in diameter, is to be built on the right bank.
W71-03195

09. MANPOWER, GRANTS AND FACILITIES

9A. Education (Extramural)

INVENTORY OF ACTIVE WATER RESOURCES RESEARCH PROJECTS IN NORTH CAROLINA,
North Carolina Water Resources Research Inst., Raleigh.
David H. Howells.
Available from NTIS as PB-196 645, $3.00 in paper copy, $0.95 in microfiche. Water Resources Research Institute Report No. 4 (Revised), July 1, 1970. 97 p. OWRR Project A-999-NC (19).

This report summarizes all water-related studies and research currently underway in North Carolina. It includes federal and state agencies, private industry, and all of the State's senior colleges and universities. Project summaries include organization, investigator (for universities), descriptions, and starting and estimated completion dates.
W71-03075

WATER RESOURCES RESEARCH INTERESTS IN THE COLLEGES AND UNIVERSITIES OF NORTH CAROLINA,
North Carolina Water Resources Research Inst., Raleigh.
David H. Howells.
Available from NTIS as PB-196 646, $3.00 in paper copy, $0.95 in microfiche. Water Resources Research Institute Report No. 3 (revised), July 1, 1970. 36 p, OWRR Project A-999-NC (18).

An inventory of water-related research interests in the following North Carolina colleges and universities: Consolidated University of North Carolina, including North Carolina State University at Raleigh, University of North Carolina at Chapel Hill, University of North Carolina at Charlotte, University of North Carolina at Greensboro; Campbell College; Duke University; East Carolina University; Guilford College; North Carolina Central University at Durham; and Western Carolina University. This report is revised annually.
W71-03076

9D. Grants, Contracts, and Research Act Allotments

INVENTORY OF ACTIVE WATER RESOURCES RESEARCH PROJECTS IN NORTH CAROLINA,
North Carolina Water Resources Research Inst., Raleigh.
For primary bibliographic entry see Field 09A.
W71-03075

WATER RESOURCES RESEARCH INTERESTS IN THE COLLEGES AND UNIVERSITIES OF NORTH CAROLINA,
North Carolina Water Resources Research Inst., Raleigh.
For primary bibliographic entry see Field 09A.
W71-03076

10. SCIENTIFIC AND TECHNICAL INFORMATION

SEDIMENTATION ENGINEERING, CHAPTER IV. SEDIMENT SOURCES AND SEDIMENT YIELDS.
American Society of Civil Engineers, New York.
For primary bibliographic entry see Field 02J.
W71-02855

IN-PLACE TREATMENT OF FOUNDATION SOILS,
California Univ., Berkeley.
For primary bibliographic entry see Field 08D.
W71-02857

AN ASSESSMENT OF OPTIMIZATION TECHNIQUES AS APPLIED TO WATER RESOURCE SYSTEMS,
Environmental Dynamics, Inc., Los Angeles, Calif.
For primary bibliographic entry see Field 06A.
W71-02878

ECONOMIC AND TECHNICAL ASPECTS OF THE USE OF MATHEMATICAL MODELS IN STATE WATER RESOURCES PLANNING PROGRAMS,
Nebraska Univ., Lincoln. Water Resources Research Inst.
For primary bibliographic entry see Field 06A.
W71-02879

SUMMARY OF THE LITERATURE ON THE INORGANIC GEOCHEMISTRY OF MERCURY,
Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 05B.
W71-02887

ANNOTATED BIBLIOGRAPHY OF REPORTS, STUDIES, AND INVESTIGATIONS RELATING TO SATELLITE HYDROLOGY,
National Environmental Satellite Center, Washington, D.C.
For primary bibliographic entry see Field 02A.
W71-02955

HYDROLOGY OF LIMESTONE TERRANES - ANNOTATED BIBLIOGRAPHY OF CARBONATE ROCKS,
Alabama Geological Survey, University.
For primary bibliographic entry see Field 02F.
W71-03109

ANNOTATED BIBLIOGRAPHY ON ARTIFICIAL RECHARGE OF GROUNDWATER, 1955-67,
Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 04B.
W71-03130

WASTE WATER RECLAMATION USING GROUNDWATER RECHARGE - A REVIEW,
New South Wales Univ., Kensington (Australia). School of Civil Engineering.
For primary bibliographic entry see Field 04B.
W71-03136

SUBJECT INDEX

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EMBRYONIC DEVELOPMENT OF THE PIKE (ESOX LUCIUS L.) WHEN INCUBATED UNDER DIFFERENT OXYGEN CONDITIONS,
W71-03064 05C

ABSORPTION
INFLUENCE OF MINERALS ON SR90 AND CS137 UPTAKE BY BEAN PLANTS,
W71-02867 05C

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W71-03109 02F

ANNOTATED BIBLIOGRAPHY ON ARTIFICIAL RECHARGE OF GROUNDWATER, 1955-67,
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EVALUATION OF ACARICIDES FOR CONTROL OF THE STRAWBERRY SPIDER MITE ON COTTON AND ALFALFA,
W71-02875 03F

ACCELERATED EROSION
NORFOLK AND W RY V MCCOY (RAILROAD'S FILL DIVERTS RIVER, ERODING FARMLAND).
W71-03286 06E

ACCESS ROUTES
PIZANIE V GAUTHREAUX (MEANING OF 'RIVER BANKS' IN DETERMINING EXTENT OF PUBLIC USE).
W71-03073 06E

ACCIDENTS
MORROW STEAMSHIP CO V SUPERIOR WATER, LIGHT AND POWER CO (LIABILITY FOR ACCIDENT CAUSED BY CABLE BEING FLOATED ON SURFACE).
W71-02838 06E

ACCLIMATIZATION
TOLERANCE OF MYSIS RELICTA TO THERMAL SHOCK AND LIGHT,
W71-03189 05C

ACCRETION(LEGAL ASPECTS)
KAVANAUGH V BAIRD (DISPUTE OVER TITLE TO RELICTION ON LAKE HURON).
W71-03050 06E

SEIBERT V CONSERVATION COMM'N (LOCATION OF LOW WATER MARK AS DETERMINING BOUNDARY BETWEEN BATTURE AND RIVER BED).
W71-03110 06E

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ARIZONA AGRICULTURE 1970.
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ARIZONA AGRICULTURE 1969.
W71-02967 03F

ARIZONA UNIV., TUCSON. DEPT. OF WATERSHED MANAGEMENT.
THE SAN SIMON WATERSHED HISTORICAL REVIEW,
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HITTMAN ASSOCIATES, COLUMBIA, MD. ENVIRONMENTAL SCIENCES AND ENGINEERING DEPT.
A SYSTEMS STUDY OF STORM RUNOFF PROBLEMS IN A NEW TOWN,
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HOKKAIDO UNIV., SAPPORO (JAPAN). PLANKTON LAB.
EFFECT OF RECENT ACIDIFICATION OF WATER ON THE PLANKTON ORGANISMS IN LAKE TOYA, HOKKAIDO (IN JAPANESE),
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HUNTING TECHNICAL SERVICES LTD., BOREHAM WOOD (ENGLAND).
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HYDROLOGICAL RESEARCH UNIT, WALLINGFORD (ENGLAND).
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IDAHO UNIV., MOSCOW. WATER RESOURCES RESEARCH INST.
SPRING EVAPOTRANSPIRATION FROM LOW SAGEBRUSH RANGE IN SOUTHERN IDAHO,
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IHARA AGRICULTURAL CHEMICALS INST., SHIMIZU (JAPAN).
TOXICITY OF PCP FOR THE 'DOJO' FISH, MISGURNUS ANGUILLICAUDATUS (CANTOR), WITH SPECIAL REFERENCE TO THE RELATION BETWEEN CONCENTATION AND IMMERSION TIME. STUDIES ON THE BIOLOGICAL ASSAY OF CHEMICALS IN FISHES (IN JAPANESE),
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ILLINOIS STATE WATER SURVEY, PEORIA. WATER QUALITY SECTION.
NUTRIENTS AND QUALITY IN IMPOUNDED WATER,
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INDUSTRIAL SCIENCE AND TECHNOLOGY AGENCY, KAWASAKI (JAPAN). GEOLOGICAL SURVEY.
OBSERVATION OF COMPACTION OF FORMATION IN THE LAND SUBSIDENCE OF NIIGATA CITY,
W71-03176 02F

INSTITUTE OF HYDROLOGY, WALLINGFORD (ENGLAND).
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W71-02818 02E

INSTITUTE OF HYDRO-SCIENCES AND WATER RESOURCES TECHNOLOGY, TEHRAN (IRAN).
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INTERNATIONAL BANK FOR RECONSTRUCTION AND DEVELOPMENT, WASHINGTON, D.C.
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IOWA STATE WATER RESOURCES RESEARCH INST., AMES.
EFFECTS OF STREAM STRAIGHTENING ON FLOOD RUNOFF CHARACTERISTICS,
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IRAN PLAN ORGANIZATION, TEHRAN.
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IRRIGATION, DRAINAGE AND FLOOD CONTROL RESEARCH COUNCIL, RAWALPINDI (PAKISTAN).
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KANSAS WATER RESOURCES RESEARCH INST., MANHATTAN.
WATER UTILIZATION ASPECTS OF WEATHER MODIFICATION AS APPLIED TO KANSAS,
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KHUZESTAN WATER AND POWER AUTHORITY, TEHRAN (IRAN).
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KOMAZAWA UNIV., TOKYO (JAPAN).
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KYOTO UNIV. (JAPAN). DISASTERS PREVENTION RESEARCH INST.
LAND SUBSIDENCE IN OSAKA,
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KYUSHU UNIV., FUKUOKA CITY (JAPAN). RESEARCH INST. OF SCIENCE AND INDUSTRY.
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KYUSHU UNIV., FUKUOKA (JAPAN). DEPT. OF ENGINEERING.
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LOUISIANA WATER RESOURCES RESEARCH INST., BATON ROUGE.
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METEOROLOGICAL DEPT., CAIRO (EGYPT).
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MICHIGAN UNIV., ANN ARBOR. DEPT. OF ENVIRONMENTAL HEALTH.
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MINISTRY OF WATER AND POWER, TEHRAN (IRAN).
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MINISTRY OF WATER AND POWER, TEHRAN (IRAN). DEPT. OF HYDROLOGY.
HYDROLOGY OF SURFACE WATER IN IRAN,

W71-02912 07A

MINISTRY OF WATER AND POWER, TEHRAN (IRAN). DIV. OF GROUNDWATER.
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MINNESOTA UNIV., MINNEAPOLIS. WATER RESOURCES RESEARCH CENTER.
LAKE EUTROPHICATION--WATER POLLUTION CAUSES, EFFECTS AND CONTROL.
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MOSCOW STATE UNIV. (USSR).
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NATIONAL ENVIRONMENTAL SATELLITE CENTER, WASHINGTON, D.C.
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NATIONAL LEAD CO., HOUSTON, TEX. BAROID DIV.
HOW TO COMBAT LOST CIRCULATION (PART 2).
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NATIONAL RESEARCH COUNCIL OF CANADA, OTTAWA (ONTARIO).
LIMIT STATE DESIGN--A UNIFIED PROCEDURE FOR THE DESIGN OF STRUCTURES,
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MODERN ROCKFILL DAMS, INCLUDING ROCKFILL REINFORCED EARTH DAMS PLANNING, DESIGN AND CONSTRUCTION,
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NATIONAL SCIENCE FOUNDATION, WASHINGTON, D.C. SPECIAL FOREIGN CURRENCY SCIENCE INFORMATION PROGRAM.
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NATIONAL WATER COMMISSION, ARLINGTON, VA.
THE NATIONAL WATER COMMISSION, ANNUAL REPORT FOR 1969 INTERIM REPORT NO 1.
W71-03295 06B

NATIONAL WATER QUALITY LAB., DULUTH, MINN.
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NAVAL OCEANOGRAPHIC OFFICE, WASHINGTON, D.C.
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NAVAL RESEARCH LAB., WASHINGTON, D.C.
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NEW HAMPSHIRE UNIV., DURHAM. WATER RESOURCES RESEARCH CENTER.
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NEW SOUTH WALES UNIV., KENSINGTON (AUSTRALIA). SCHOOL OF CIVIL ENGINEERING.
WASTE WATER RECLAMATION USING GROUNDWATER RECHARGE - A REVIEW,
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NORTH CAROLINA STATE UNIV., RALEIGH. DEPT. OF ZOOLOGY.
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NORTHERN ILLINOIS UNIV., DE KALB. DEPT. OF GEOGRAPHY.
THE CIMARRON NATIONAL GRASSLAND A STUDY IN LAND USE ADJUSTMENT,
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NORTHWESTERN UNIV., CHICAGO, ILL. ECONOMETRICS CENTER.
COST-BENEFIT ANALYSIS FOR INLAND NAVIGATION IMPROVEMENTS,
W71-02981 06B

NOTRE DAME UNIV., IND. DEPT. OF CIVIL ENGINEERING.
BIOGEOCHEMICAL MODELING OF EUTROPHIC LAKES FOR WATER QUALITY IMPROVEMENT,
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OHIO AGRICULTURAL RESEARCH AND DEVELOPMENT CENTER, WOOSTER.
SOIL HYDRAULIC CONDUCTIVITY MEASUREMENT BY FIELD MONOLITHS,
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OHIO STATE UNIV., COLUMBUS. DEPT. OF CIVIL ENGINEERING AND CALIFORNIA UNIV., BERKELEY. DEPT. OF CIVIL ENGINEERING.
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OREGON STATE UNIV., CORVALLIS. DEPT. OF CIVIL ENGINEERING.
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OREGON UNIV., EUGENE. BUREAU OF GOVERNMENTAL RESEARCH AND SERVICE.
CENTRAL OREGON COAST, VOLUME I. PHYSICAL CONDITIONS AND PRESENT DEVELOPMENT.
W71-03199 06B

CENTRAL OREGON COAST. VOLUME II. ECONOMIC PATTERNS.
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W71-03206 06B

CENTRAL OREGON COAST. VOLUME IX DEVELOPMENT PROBLEMS AND POTENTIALS.
W71-03207 06B

ORGANIZATION FOR ECONOMIC CO-OPERATION AND DEVELOPMENT, PARIS (FRANCE).
ADVISORY CONFERENCE ON TUNNELLING, JUNE 22-26, 1970, WASHINGTON, D.C. ORGANIZATION FOR ECONOMIC CO-OPERATION AND DEVELOPMENT (OECD) WORKING PAPERS.
W71-03208 08A

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PAKISTAN PLANNING COMMISSION, RAWALPINDI. WATER AND POWER DIV.
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PENNSYLVANIA STATE UNIV., UNIVERSITY PARK. DEPT. OF CIVIL ENGINEERING.
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A. Center of Competence		
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CENTERS OF COMPETENCE AND THEIR SUBJECT COVERAGE

- Ground and surface water hydrology at the Water Resources Division of the U.S. Geological Survey, U.S. Department of the Interior.
- Metropolitan water resources management at the Center for Urban Studies of the University of Chicago.
- Eastern United States water law at the College of Law of the University of Florida.
- Policy models of water resources systems at the Department of Water Resources Engineering of Cornell University.
- Water resources economics at the Water Resources Research Institute of Rutgers University.
- Design and construction of hydraulic structures; weather modification; and evaporation control at the Bureau of Reclamation, Denver, Colorado.
- Eutrophication at the Water Resources Center of the University of Wisconsin, jointly sponsored by the EPA, Soap and Detergent Association, and the Agricultural Research Service.
- Water resources of arid lands at the Office of Arid Lands Studies of the University of Arizona.
- Water well construction technology at the National Water Well Association.

Supported by the Environmental Protection Agency in cooperation with WRSIC.

- Thermal pollution at the Department of Sanitary and Water Resources Engineering of Vanderbilt University.
- Textile wastes pollution at the School of Textiles of North Carolina State University.
- Water quality requirements for freshwater and marine organisms at the College of Fisheries of the University of Washington.
- Wastewater treatment and management at the Center for Research in Water Resources of the University of Texas.
- Agricultural livestock wastes at the Department of Agricultural Engineering of Iowa State University.

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